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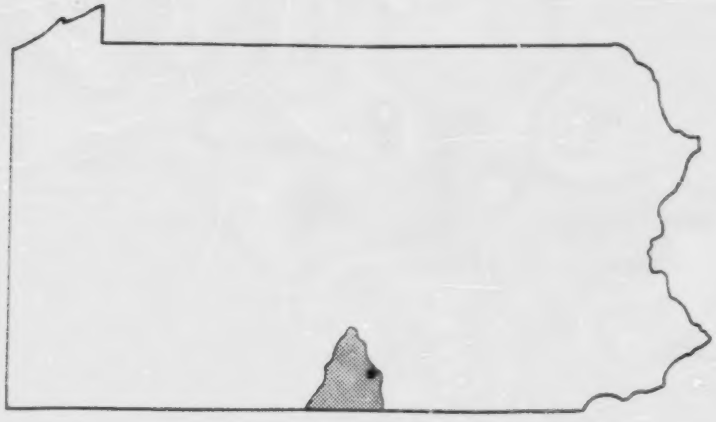
FLOOD INSURANCE STUDY

COMPLETED
78
ORIGINAL

TOWNSHIP OF SOUTHAMPTON, PENNSYLVANIA
FRANKLIN COUNTY



MAY 15, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 421657

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Exhibit 2 - Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
TOWNSHIP OF SOUTHAMPTON, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Southampton, Franklin County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Michael Baker, Jr., Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-83-1171. This work was completed in September 1984.

1.3 Coordination

In April 1983, an initial Consultation and Coordination Officer's (CCO) meeting, attended by representatives of the Township of Southampton, FEMA, and Michael Baker, Jr., Inc. (the study contractor), was held to identify the streams to be studied by detailed methods. Results of the hydrologic analyses were coordinated with the Baltimore District of the U. S. Army Corps of Engineers (COE), the U. S. Geological Survey (USGS), and the consulting engineers of Greenhorne and O'Mara, Inc.

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An interim coordination meeting between representatives of the township and the study contractor was held on October 6, 1983. During this meeting, existing reports, mapping, historical data, and photographs of past flood events were requested. Study contractor representatives also examined the newspaper News - Chronicle for accounts of past flood events.

On June 13, 1985, a final CCO meeting was held to review the results of this study. This meeting was attended by representatives of the township, FEMA, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Southampton, Franklin County, Pennsylvania. Not included in this study is the Borough of Orrstown, which is located within the corporate boundaries of Southampton. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: Conodoguinet Creek, for its entire stream length affecting the community; Middle Spring Creek, from its confluence with Conodoguinet Creek to the Township of Shippensburg corporate limits and from the upstream corporate limits of the Borough of Shippensburg to a point approximately 350 feet upstream of the confluence of Gum Run; Gum Run, from its confluence with Middle Spring Creek to the Interstate Route 81 embankment; Muddy Run, from its confluence with the Conodoguinet Creek to approximately 500 feet upstream of Muddy Run Road; and Rowe Run, from its confluence with Muddy Run to the corporate limits. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through September 1989.

Approximate methods were used to study Griers Hollow, Mains Run, Furnace Run, portions of Muddy Run, and portions of an unnamed tributary to Conodoguinet Creek adjacent to Mongul Hill Road. An unnamed tributary to Furnace Run was also studied by approximate methods; however, it was not shown on the maps since the flooding would not exceed 200 feet in width. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Southampton.

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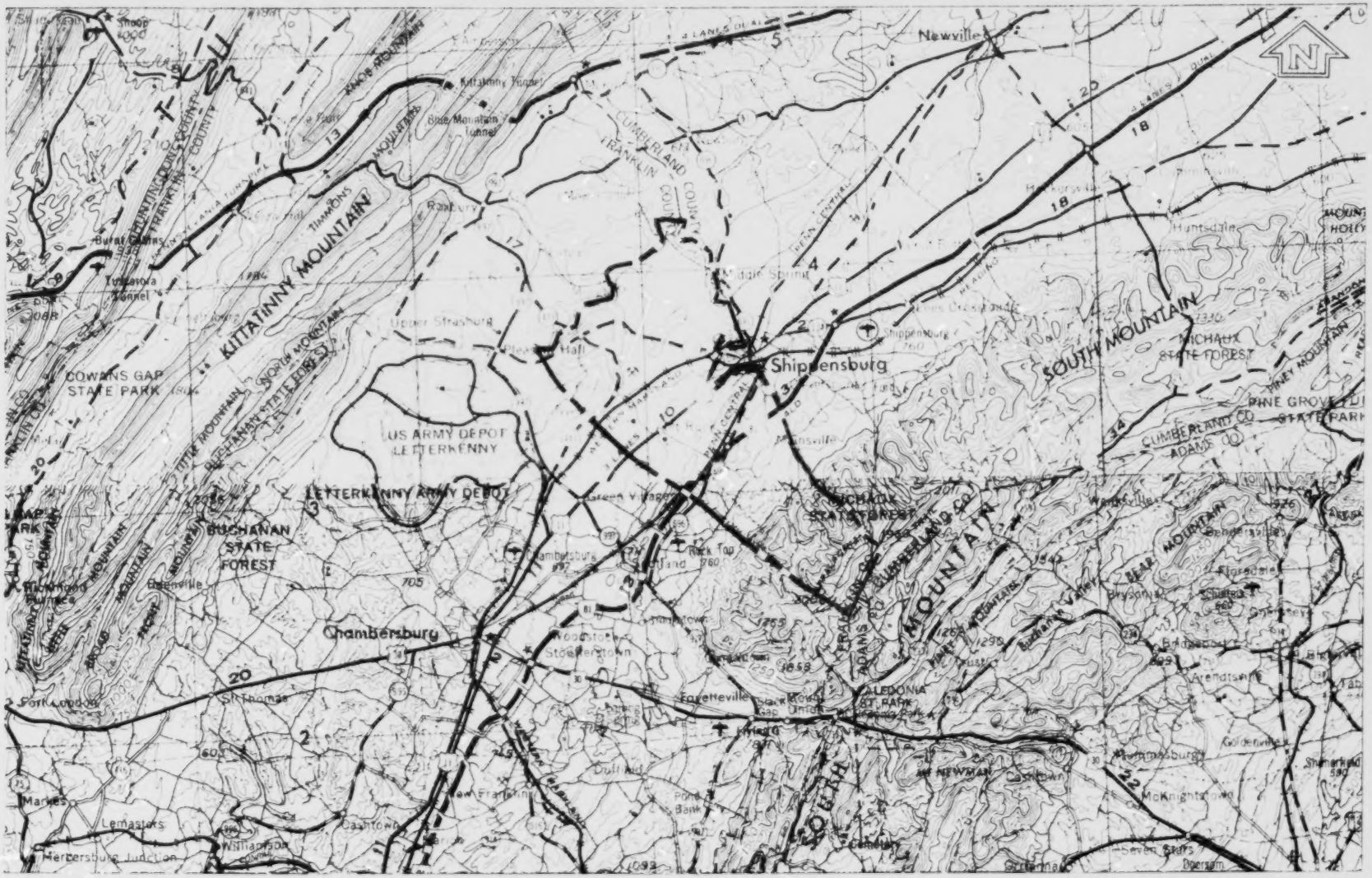

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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2.2 Community Description

The Township of Southampton is located in northeastern Franklin County in southeastern Pennsylvania. The township is located approximately 40 miles southwest of Harrisburg and approximately 5 miles northeast of Chambersburg. It is bordered by the Township of Lurgan to the northwest, the Townships of Letterkenny and Green to the southwest, the Township of Southampton (Cumberland County) to the northeast and southeast, and the Borough of Shippensburg and Township of Shippensburg to the northeast. Part of the incorporated Borough of Shippensburg and all of the incorporated Borough of Orrstown lie within the township borders. The total land area contained within the corporate limits is 36.8 square miles. The population of Southampton increased from 3,292 in 1970 to 4,604 in 1980 (Reference 1).

Conodoguinet Creek defines the northwestern most corporate limits. It flows northeast through the township for approximately 7.4 miles and then flows approximately 66 miles to its confluence with the Susquehanna River. Conodoguinet Creek has a total drainage area of 506 square miles at its confluence, with 153 square miles at the downstream corporate limits of Southampton.

Middle Spring Creek, which defines part of the northeastern corporate limits, flows northwest to its confluence with Conodoguinet Creek for approximately 6.5 miles. It has total drainage area of 47.6 square miles. Most of the watercourse, approximately 6 miles, lies within the Township of Southampton and the rest lies within the Township and Borough of Shippensburg.

Gum Run defines part of the southeastern corporate limits and flows northwest to its confluence with Middle Spring Creek just south of the Shippensburg corporate limits. The watercourse meanders for approximately 5.5 miles from its headwaters in South Mountain, and it has a total drainage area is 7.1 square miles.

Muddy Run is located in a sparsely populated rural area in southwestern Southampton and is a tributary to Conodoguinet Creek. It flows in a northeast direction for approximately 13 miles of which approximately 4.8 miles lie within the township. Muddy Run has a total drainage area of 42.1 square miles.

Rowe Run is a tributary to Muddy Run and flows north for approximately 5 miles from its headwaters in Letterkenny. Approximately 2.5 miles of its watercourse lies within Southampton. Rowe Run has a total drainage area of 18 square miles.

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Development within the Township of Southampton is mainly agricultural and residential with some commercial development along U. S. Route 11 in and around Shippensburg. Flood plains within the township contain very little development and are used primarily for agriculture and recreation. Major transportation through the township is via U. S. Route 11, Interstate Route 81, State Route 696, State Route 533, and State Route 433. CONRAIL also provides service to the area.

The climate in south central Pennsylvania is humid continental. Summer and winter temperatures average 74.9 degrees Fahrenheit (°F) and 31.6°F, respectively. Annual average precipitation in the region is 41.3 inches, with 36.6 inches of snowfall (Reference 2).

Two physiographic provinces dominate the township. The Appalachian Valley and Ridge Province covers most of the Cumberland (or Great) Valley extending uninterrupted through southeastern Pennsylvania from the Delaware River to the Maryland/Pennsylvania state line. The Blue Ridge Province, so named because it is the northern terminus of the Blue Ridge in Virginia, covers the higher elevation of South Mountain in the southeastern corner of the township.

The geology of the area presents two separate and distinct watershed models. The Conodoguinet Creek and Muddy Run watershed are underlain primarily with Martinsburg Shale of Ordovician age; while the Middle Spring Creek, Gum Run, and Rowe Run watershed are underlain primarily with limestones and dolomites of the Cambrian, Canadian, and Ordovician ages with the higher elevations of Middle Spring Creek and Gum Run underlain with Cambrian quartzites and related rocks (Reference 3). The terrain within Southampton varies from gently rolling hills along the floor of Cumberland Valley to the lofty massiveness of South Mountain. The elevations within the community range from 540 feet to 2,100 feet.

2.3 Principal Flood Problems

The history of flooding in the Township of Southampton indicates that flooding occurs infrequently and results in only minor damage to private property. This is due to the predominance of agricultural farm land and forested areas along the streams in the township. The two most severe floods occurred in March 1936 as a result of spring rains and snowmelt, and in June 1972 from Tropical Storm Agnes. Information regarding discharges during these two events was not available.

While the potential for development in the flood plain exists, actual residential development is sufficiently removed so as to limit structural flooding mainly to basements and out buildings. No damage estimates were available for the township; however, conversations with local officials and residents indicated that damage to agricultural crops and bridges was

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not uncommon. Several bridges were destroyed by Tropical Storm Agnes and have since been replaced. Bank erosion along the major watercourses is prevalent within the community.

2.4 Flood Protection Measures

There are no flood protection structures within the township. As previously mentioned, stream bank erosion is a problem throughout the area and has been treated by riprapping and use of gabions in several locations. This has contained localized erosion problems but is ineffective as a flood mitigation device.

An abandoned gristmill dam does exist on Middle Spring Creek downstream of Shippensburg. No substantial retention is created by this dam with the exception of very large flooding events.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The hydrologic analyses for Middle Spring Creek, Gum Run, and Rowe Run were performed using available discharge-frequency data from the Flood

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Insurance Study for the Borough of Shippensburg (Reference 4). Middle Spring Creek had been analyzed and reported in that study (Reference 4). The watershed for Middle Spring Creek is hydrologically and geologically similar to both Gum and Rowe Runs, all of which are underlain predominantly with calcareous formations of limestone and dolomite (calcium carbonates). Intrinsic to such formations is that a substantial amount of drainage occurs through solution cavities reducing what would otherwise be stream flow; therefore, the hydrologic analysis in the Borough of Shippensburg study was used to provide the basic discharge-drainage area-frequency relationships for Middle Spring Creek, Gum Run, and Rowe Run (Reference 4).

For the non-carbonate underlain streams of Conodoguinet Creek and Muddy Run, no authoritative flood discharge information was available. Discharges for these streams were developed using methods described in Water Resources Investigations 82-21 (Reference 5). These results were supplemented with USGS gage analysis data on Newburg Run (gage No. 01569340), a tributary to Conodoguinet Creek located less than 2 miles downstream of the limit of this study area. Newburg Run is hydrologically and geologically similar to Conodoguinet Creek and Muddy Run.

For both watershed models, a least-squares fit was performed relating drainage area size to discharge for each return period under investigation. The resulting equations relating drainage area to discharge produced favorable correlation coefficients indicating consistency with both the discharges reported in the Flood Insurance Study for the Borough of Shippensburg for calcareous underlain streams and with discharges developed by the USGS through other methods for non-carbonate underlain streams (Reference 4).

Comparison of proposed discharges with those derived from other methods were made. For the calcareous model, proposed discharges were compared with those developed using Water Resources Investigation 82-21 regression equations and were found to be within projected standard error (Reference 5). For the non-carbonate model, proposed discharges were compared with those developed using Field Manual of Procedure PSU-IV for Estimating Design Flood Peaks on Ungaged Pennsylvania Watersheds and the USGS provided confidence interval on Newburg Run discharges (Reference 6). Proposed discharges were within the standard error and the 90 percent confidence interval, respectively.

Flood discharges for the approximate study on Furnace Run, an unnamed tribuatary to Furnace Run, and Muddy Run were based on the flood frequency analysis described in USGS Water-Supply Paper 1672 (Reference 7). These discharges were used in conjunction with USGS topographic maps to determine approximate flood boundaries (Reference 8).

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The equations developed for each watershed model were then used to determine peak discharges at various points along the watercourses in the township. A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONODOGUINET CREEK					
At downstream corporate limits	152.9	8,290	13,700	17,200	29,500
Immediately upstream of confluence of Middle Spring Creek	105.3	6,480	11,200	14,300	25,400
At McClay's Mill Road	101.7	6,330	11,000	14,100	25,000
At Legislative Route 28009 (Roxbury Road)	97.2	6,140	10,800	13,800	24,500
At Township Route 368 (Hickory Run Road)	54.7	4,200	7,930	10,400	19,400
MIDDLE SPRING CREEK					
At confluence with Conodoguinet Creek	47.6	2,330	3,530	4,090	5,160
At McClay's Mill Road	45.0	2,190	3,320	3,840	4,840
At confluence of Burd Run	43.1	2,090	3,160	3,660	4,620
At Borough of Shippensburg corporate limits	21.5	1,100	1,600	1,900	2,400
At confluence of Gum Run	18.6	830	1,250	1,450	1,830
GUM RUN					
At confluence with Middle Spring Creek	7.1	290	430	500	630
MUDDY RUN					
At confluence with Conodoguinet Creek	42.1	3,530	6,900	9,140	17,400
At State Route 533 (Orrstown Road)	41.4	3,500	6,840	9,070	17,300
At confluence of Rowe Run	40.4	3,440	6,750	8,960	17,100
At State Route 433 (Rowe Run Road)	22.0	2,300	4,880	6,650	13,400
At Muddy Run Road	21.5	2,260	4,820	6,570	13,200

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ROWE RUN					
At confluence with Muddy Run	18.0	800	1,200	1,400	1,760
Approximately 5,200 feet upstream of confluence with Muddy Run	17.4	770	1,150	1,350	1,700
At State Route 433 (Rowe Run Road) at Pinola	17.0	750	1,130	1,320	1,660
Approximately 740 feet downstream of Legislative Route 28015 (Pinola Road)	11.8	510	750	880	1,110
At Legislative Route 28015 (Pinola Road)	11.2	480	710	830	1,040
Approximately 2,600 feet upstream of Legislative Route 28015 (Pinola Road)	5.9	240	350	410	520
At upstream corporate limits	5.4	210	310	370	470

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the streams studied by detailed methods were obtained by aerial photographs (Reference 9). The below water sections were obtained by field measurement. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness values (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations for the streams and flood plain areas. The channel "n" and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

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Stream	Channel "n"	Overbank "n"
Conodoguinet Creek	0.035	0.045-0.100
Middle Spring Creek	0.040-0.047	0.055-0.090
Gum Run	0.045	0.065-0.090
Muddy Run	0.040-0.050	0.060-0.090
Rowe Run	0.040-0.050	0.060-0.090

Manning's "n" values in the ranges given above do not necessarily reflect those values used at structures.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 10). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Conodoguinet Creek, Middle Spring Creek, Gum Run, and Rowe Run were calculated using the slope/area method. The starting water-surface elevations for Muddy Run were determined assuming coincident flood peaks with Conodoguinet Creek.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 11).

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For the streams studied by approximate methods, only the 100-year flood plain boundaries have been shown. The approximate flood boundaries were delineated using the Flood Hazard Boundary Map for the Township of Southampton where available (Reference 12). Adjustments were made using the more detailed topographic mapping developed for this study (Reference 11). On those streams not covered by the Flood Hazard Boundary Map, flood plain boundaries were delineated using USGS topographic maps (Reference 8).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway widths for Conodoguinet Creek, Middle Spring Creek, and Gum Run extend beyond the corporate limits.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Conodoguinet Creek								
A	600	728/58	5,953	2.4	545.8	545.8	546.7	0.9
B	1,900	427/43	3,390	4.2	546.3	546.3	547.1	0.8
C	3,000	457/130	3,902	3.7	547.6	547.6	548.5	0.9
D	4,000	758/670	4,350	3.3	548.4	548.4	549.3	0.9
E	4,500	899/860	5,711	2.5	549.3	549.3	549.9	0.6
F	5,700	394/263	3,028	4.7	549.8	549.8	550.7	0.9
G	6,500	347/85	2,772	5.2	551.0	551.0	551.6	0.6
H	7,500	260/65	3,240	4.4	554.7	554.7	555.0	0.3
I	8,700	224/57	2,526	5.6	555.4	555.4	555.9	0.5
J	10,300	335/50	3,828	3.7	556.8	556.8	557.7	0.9
K	11,300	508/30	4,762	3.0	557.6	557.6	558.6	1.0
L	12,700	295/85	3,071	4.6	558.4	558.4	559.3	0.9
M	13,300	282/240	2,847	4.6	558.9	558.9	559.8	0.9
N	14,100	333/72	3,613	3.9	559.9	559.9	560.9	1.0
O	15,100	347/41	3,591	3.9	560.7	560.7	561.7	1.0
P	16,500	361/324	2,790	5.1	562.2	562.2	563.2	1.0
Q	17,500	374/340	3,511	4.0	563.6	563.6	564.5	0.9
R	18,300	433/380	3,619	3.9	564.4	564.4	565.3	0.9
S	19,500	361/38	2,852	4.9	565.7	565.7	566.5	0.8
T	20,200	142/75	1,656	8.3	567.7	567.7	568.3	0.6
U	21,600	156/45	1,798	7.7	570.2	570.2	570.6	0.4
V	22,500	227/44	1,913	7.2	571.9	571.9	572.5	0.6

[1]Feet above corporate limits
[2]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

FLOODWAY DATA

CONODOGUINET CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Conodoguinet Creek (continued)								
W	23,500[1]	254/54	2,319	5.6	574.4	574.4	575.3	0.9
X	24,200[1]	556/519	4,382	2.4	576.2	576.2	577.2	1.0
Y	25,300[1]	244/39	1,751	5.9	577.1	577.1	577.6	0.5
Z	26,600[1]	238/29	1,930	5.4	579.7	579.7	580.6	0.9
AA	28,100[1]	314/271	2,216	4.7	582.2	582.2	583.2	1.0
AB	29,200[1]	258/220	1,867	5.6	583.8	583.8	584.7	0.9
AC	30,700[1]	420/250	3,447	3.0	586.0	586.0	587.0	1.0
AD	32,100[1]	471/38	2,998	3.5	587.1	587.1	588.0	0.9
AE	33,500[1]	233/27	1,735	6.0	590.5	590.5	590.7	0.2
AF	34,900[1]	211/148	1,567	6.6	593.2	593.2	594.0	0.8
AG	36,000[1]	345/300	2,470	4.2	595.3	595.3	596.3	1.0
AH	36,800[1]	280/55	2,111	4.9	596.3	596.3	597.2	0.9
AI	38,600[1]	415/33	2,476	4.2	599.0	599.0	600.0	1.0
AJ	39,800[1]	540/26	3,370	3.1	601.0	601.0	602.0	1.0
AK	40,700[1]	421/72	2,195	4.7	602.3	602.3	603.2	0.9
Middle Spring Creek								
A	200[2]	113/90	707	5.8	544.7	542.5[4]	543.3	0.8
B	600[2]	80/49	536	7.6	544.7	543.7[4]	544.7	1.0
C	1,100[2]	111/94	667	6.1	546.2	546.2	546.4	0.2
D	1,800[2]	135/97	1,013	4.0	547.7	547.7	548.6	0.9

[1]Feet above corporate limits

[2]Feet above confluence with Conodoguinet Creek

[3]Width/width within corporate limits

[4]Elevation computed without consideration of backwater from Conodoguinet Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

FLOODWAY DATA

CONODOGUINET CREEK - MIDDLE SPRING CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Middle Spring Creek (continued)								
E	3,200	407/15	2,252	1.8	549.6	549.6	550.5	0.9
F	4,000	366/195	2,048	2.0	550.2	550.2	551.0	0.8
G	5,200	321/70	1,760	2.3	551.2	551.2	552.0	0.8
H	5,700	461/442	2,371	1.7	551.6	551.6	552.5	0.9
I	6,200	472/447	2,050	2.0	551.9	551.9	552.8	0.9
J	6,700	460/445	1,594	2.6	552.8	552.8	553.7	0.9
K	7,500	393/370	1,278	3.2	554.1	554.1	555.1	1.0
L	8,300	134/105	643	6.4	556.5	556.5	557.3	0.8
M	8,900	142/100	932	4.4	558.8	558.8	559.8	1.0
N	10,100	352/15	2,082	2.0	560.9	560.9	561.7	0.8
O	11,500	99/74	650	6.3	562.6	562.6	563.6	1.0
P	12,000	60/33	478	8.6	566.0	566.0	566.1	0.1
Q	13,000	136/120	984	4.2	568.7	568.7	569.6	0.9
R	13,800	254/44	1,329	3.1	570.1	570.1	571.1	1.0
S	14,900	65/35	507	8.1	572.2	572.2	573.2	1.0
T	15,800	111/40	799	4.8	575.4	575.4	576.4	1.0
U	16,300	193/100	1,190	3.2	578.3	578.3	579.2	0.9
V	16,600	123/48	940	4.1	578.6	578.6	579.5	0.9
W	16,800	178/152	2,065	1.9	585.6	585.6	585.6	0.0
X	17,500	155/130	1,248	3.1	585.7	585.7	585.7	0.0
Y	18,300	156/23	1,171	3.3	586.2	586.2	586.5	0.3

[1]Feet above confluence with Conodoguinet Creek

[2]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOODWAY DATA

MIDDLE SPRING CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Middle Spring Creek (continued)								
Z	19,000	312/50[2]	1,656	2.3	586.6	586.6	587.0	0.4
AA	20,100	75/42[2]	513	7.5	587.2	587.2	587.9	0.7
AB	20,700	107/87[2]	820	4.7	589.5	589.5	590.3	0.8
AC	21,600	120/25[2]	921	4.2	591.1	591.1	592.0	0.9
AD	23,100	178/92[2]	1,072	3.6	593.5	593.5	594.4	0.9
AE	24,300	134/20[2]	881	4.4	597.7	597.7	598.6	0.9
AF	25,100	93/68[2]	553	6.9	599.8	599.8	600.6	0.8
AG	26,300	218/76[2]	1,706	2.1	604.9	604.9	605.7	0.8
AH	27,100	532/440[2]	2,182	1.7	605.5	605.5	606.3	0.8
AI	27,800	404/390[2]	869	4.2	607.7	607.7	608.3	0.6
AJ	28,400	737/205[2]	2,266	1.6	609.7	609.7	610.6	0.9
AK	29,400	286/10[2]	671	5.5	613.7	613.7	613.9	0.2
AL	30,100	440/15[2]	1,371	2.7	618.3	618.3	619.1	0.8
AM	31,800	98/15[2]	286	6.6	624.3	624.3	624.8	0.5
AN	37,050	300/125[2]	870	2.2	657.4	657.4	658.2	0.8
AO	37,650	150	301	6.3	660.9	660.9	661.5	0.6
AP	38,250	144	729	2.6	667.5	667.5	668.4	0.9
AQ	38,800	69	330	5.8	668.7	668.7	669.3	0.6
AR	39,300	60	308	4.7	671.1	671.1	671.9	0.8

[1]Feet above confluence with Conodoguinet Creek
[2]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

FLOODWAY DATA

MIDDLE SPRING CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Gum Run								
A	150[1]	28/16[3]	178	2.8	670.3	670.3	670.4	0.1
B	1,200[1]	114/15[3]	274	1.8	670.7	670.7	671.7	1.0
C	1,650[1]	170/92[3]	614	0.8	676.7	676.7	677.5	0.8
D	2,600[1]	61/55[3]	97	5.2	684.2	684.2	684.8	0.6
E	3,300[1]	70/60[3]	144	3.5	691.5	691.5	692.1	0.6
F	4,100[1]	73/65[3]	223	2.2	697.9	697.9	698.9	1.0
G	4,500[1]	58/40[3]	154	3.2	699.8	699.8	700.6	0.8
H	4,800[1]	122/110[3]	228	2.2	703.6	703.6	704.0	0.4
I	5,600[1]	23/15[3]	53	9.4	709.4	709.4	709.4	0.0
J	5,900[1]	110/60[3]	246	2.0	711.1	711.1	711.8	0.7
Muddy Run								
A	900[2]	310	2,886	3.2	577.1	577.1	578.1	1.0
B	1,500[2]	289	2,844	3.2	577.7	577.7	578.6	0.9
C	2,000[2]	447	4,164	2.2	578.1	578.1	579.0	0.9
D	3,400[2]	431	3,721	2.5	578.8	578.8	579.7	0.9
E	4,400[2]	534	4,438	2.1	579.3	579.3	580.2	0.9
F	5,000[2]	277	2,589	3.5	580.2	580.2	581.0	0.8
G	5,900[2]	312	2,476	3.7	581.1	581.1	581.9	0.8
H	6,600[2]	350	2,672	3.4	582.1	582.1	583.0	0.9
I	8,200[2]	361	2,938	3.1	584.1	584.1	585.1	1.0
J	9,400[2]	398	3,183	2.8	585.3	585.3	586.3	1.0
K	9,850[2]	403	2,928	3.1	585.8	585.8	586.8	1.0

[1]Feet above confluence with Middle Spring Creek

[2]Feet above confluence with Conodoguinet Creek

[3]Width/width within corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOODWAY DATA

GUM RUN - MUDDY RUN

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muddy Run (continued)								
L	11,000[1]	268	2,188	4.1	587.7	587.7	588.7	1.0
M	11,800[1]	309	2,673	3.4	589.0	589.0	590.0	1.0
N	12,600[1]	284	2,226	4.0	590.2	590.2	591.1	0.9
O	13,400[1]	286	2,660	2.5	592.9	592.9	593.6	0.7
P	14,400[1]	269	2,061	3.2	593.6	593.6	594.4	0.8
Q	15,400[1]	272	2,162	3.1	594.4	594.4	595.3	0.9
R	16,200[1]	360	2,316	2.9	595.0	595.0	596.0	1.0
S	17,400[1]	282	1,666	4.0	596.7	596.7	597.6	0.9
T	18,600[1]	285	3,195	2.1	601.8	601.8	602.7	0.9
U	19,000[1]	371	2,666	2.5	602.0	602.0	602.9	0.9
Rowe Run								
A	500[2]	106	211	6.6	585.8	580.2[3]	580.4	0.2
B	1,100[2]	109	467	3.0	585.8	583.2[3]	583.9	0.7
C	1,700[2]	107	435	3.3	585.8	584.2[3]	584.7	0.5
D	2,600[2]	56	300	4.7	585.8	585.3[3]	586.1	0.8
E	3,400[2]	55	263	5.3	586.9	586.9	587.9	1.0
F	4,400[2]	189	779	1.3	588.5	588.5	589.5	1.0
G	5,200[2]	129	602	2.2	590.9	590.9	591.0	0.1
H	6,000[2]	116	547	2.5	591.2	591.2	591.5	0.3
I	6,800[2]	96	375	3.6	591.9	591.9	592.5	0.6
J	7,300[2]	47	137	9.6	593.3	593.3	593.3	0.0

[1]Feet above confluence with Conodoguinet Creek

[2]Feet above confluence with Muddy Run

[3]Elevation computed without consideration of backwater from Muddy Run

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOODWAY DATA

MUDDY RUN -ROWE RUN

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Rowe Run (continued)								
K	7,800	73	220	4.0	597.9	597.9	597.9	0.0
L	8,300	67	273	3.2	599.0	599.0	599.1	0.1
M	8,600	41	126	6.6	600.4	600.4	601.1	0.7
N	9,400	61	201	4.1	606.0	606.0	606.0	0.0
O	10,000	70	192	4.3	608.1	608.1	608.2	0.1
P	10,500	86	307	2.7	611.8	611.8	611.8	0.0
Q	11,100	90	220	1.9	615.0	615.0	615.3	0.3
R	12,100	23	59	6.9	617.4	617.4	617.8	0.4
S	13,300	31	139	2.9	621.5	621.5	622.3	0.8
T	14,200	46	136	3.0	623.3	623.3	623.8	0.5

[1]Feet above confluence with Muddy Run

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

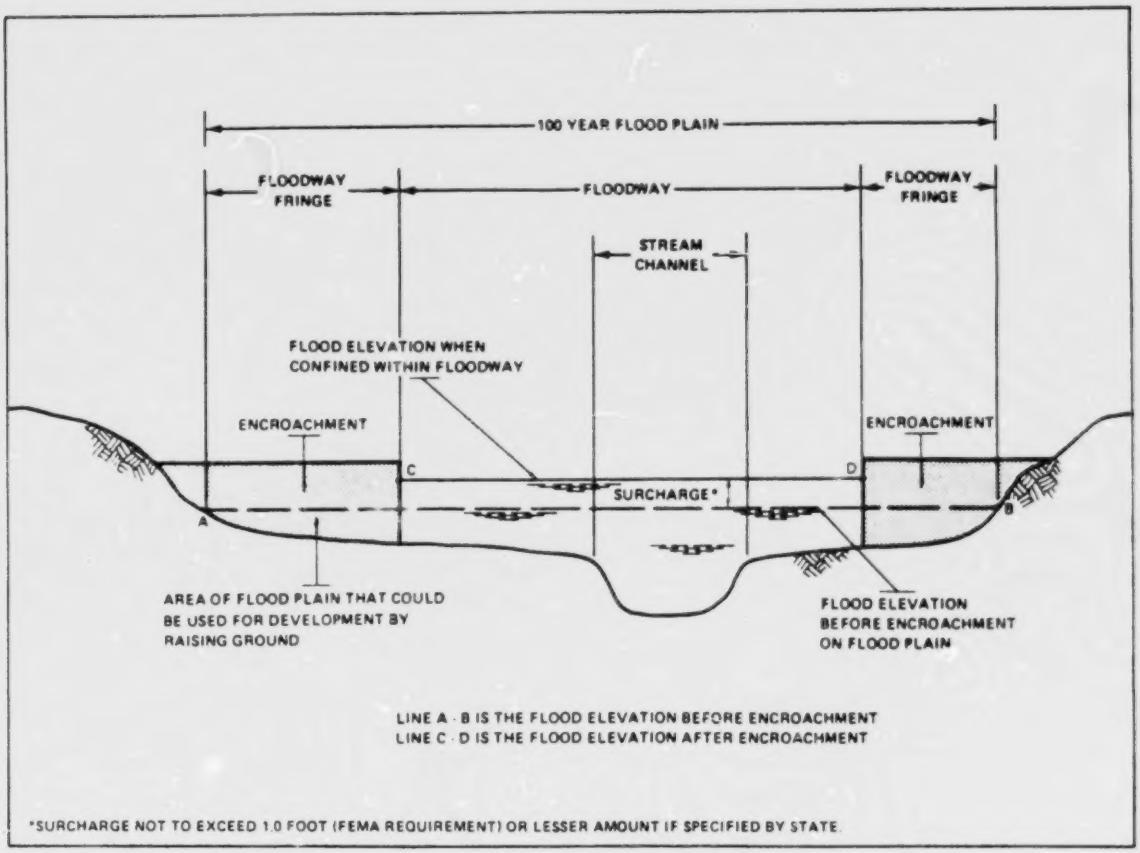
TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOODWAY DATA

ROWE RUN

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2 for certain downstream cross sections of Middle Spring Creek and Rowe Run are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the

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determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the Township of Southampton.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Township of Southampton are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Conodoguinet Creek							
Reach 1	05	-3.4	-1.2	+3.3	035	A7	Varies
Middle Spring Creek							
Reach 1	05	-1.5	-0.4	+0.7	015	A3	Varies
Reach 2	05	-0.8	-0.3	+0.4	010	A2	Varies
Reach 3	10	-0.9	-0.3	+0.4	010	A2	Varies
Gum Run							
Reach 1	10	-0.6	-0.1	+0.2	005	A1	Varies
Muddy Run							
Reach 1	05	-3.2	-1.0	+3.2	030	A6	Varies
Rowe Run							
Reach 1	05	-0.8	-0.3	+0.4	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

FLOOD INSURANCE ZONE DATA

CONODOGUINET CREEK - MIDDLE SPRING CREEK - GUM RUN - MUDDY RUN - ROWE RUN

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Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A1, A2, A3, A6, and A7:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Township of Southampton is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

The Flood Insurance Study for the Borough of Shippensburg has been published (Reference 4). The results of that study are in complete agreement with the results of this study for Southampton.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously published Flood Hazard Boundary Map for the Township of Southampton (Reference 12).

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7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Room 700, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

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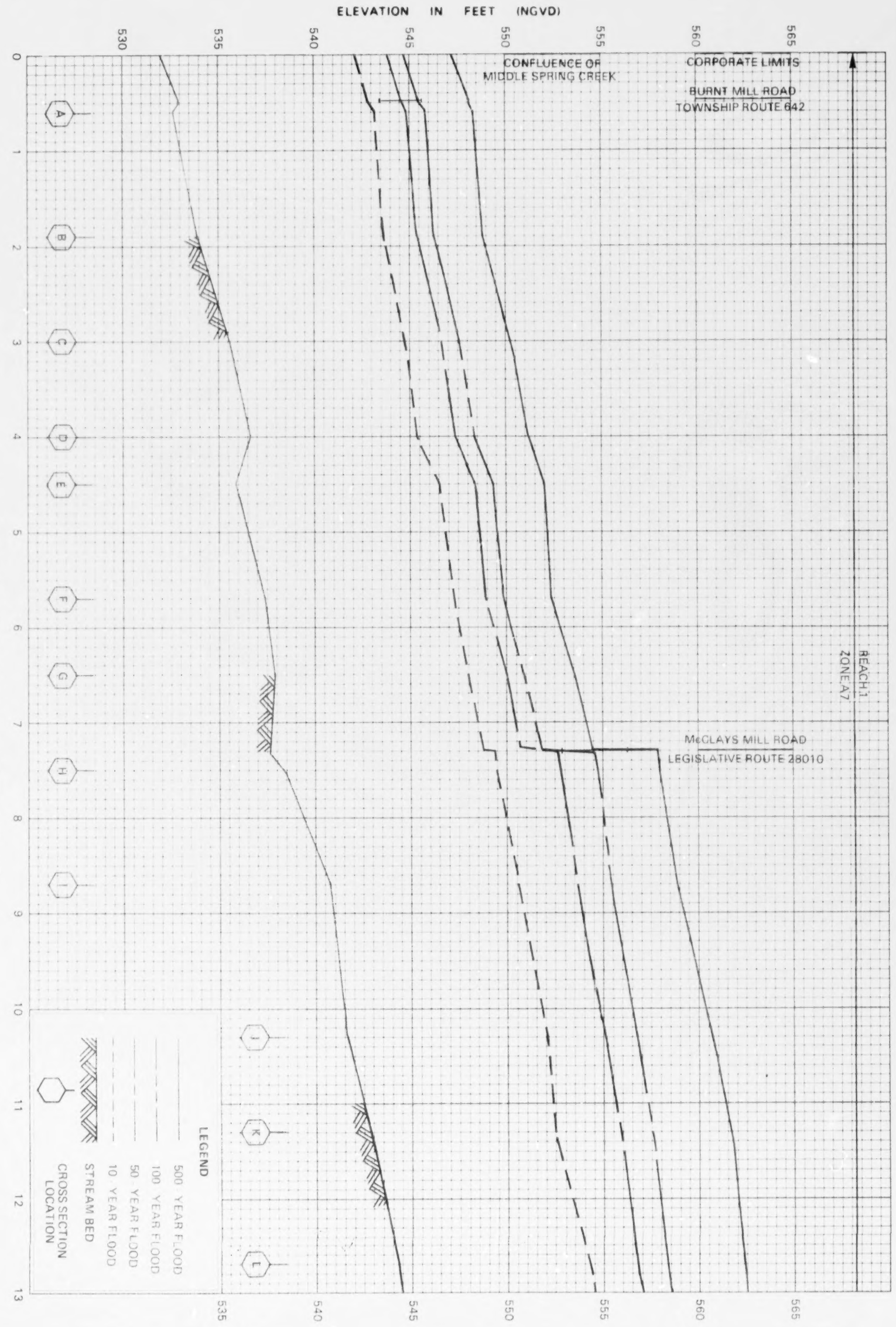

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOOD PROFILES

CONODOGUINET CREEK

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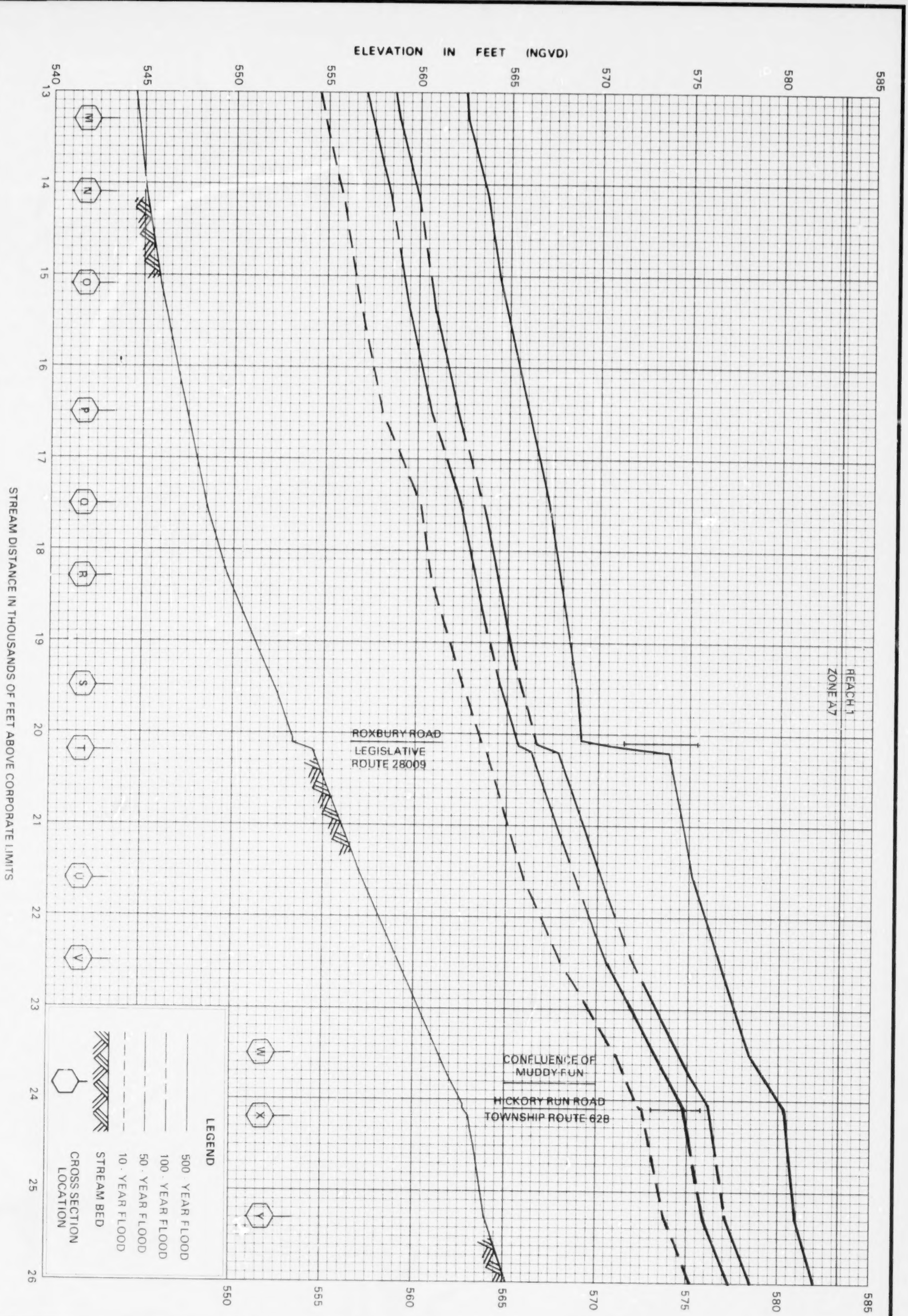

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FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOOD PROFILES

CONODOGUINET CREEK

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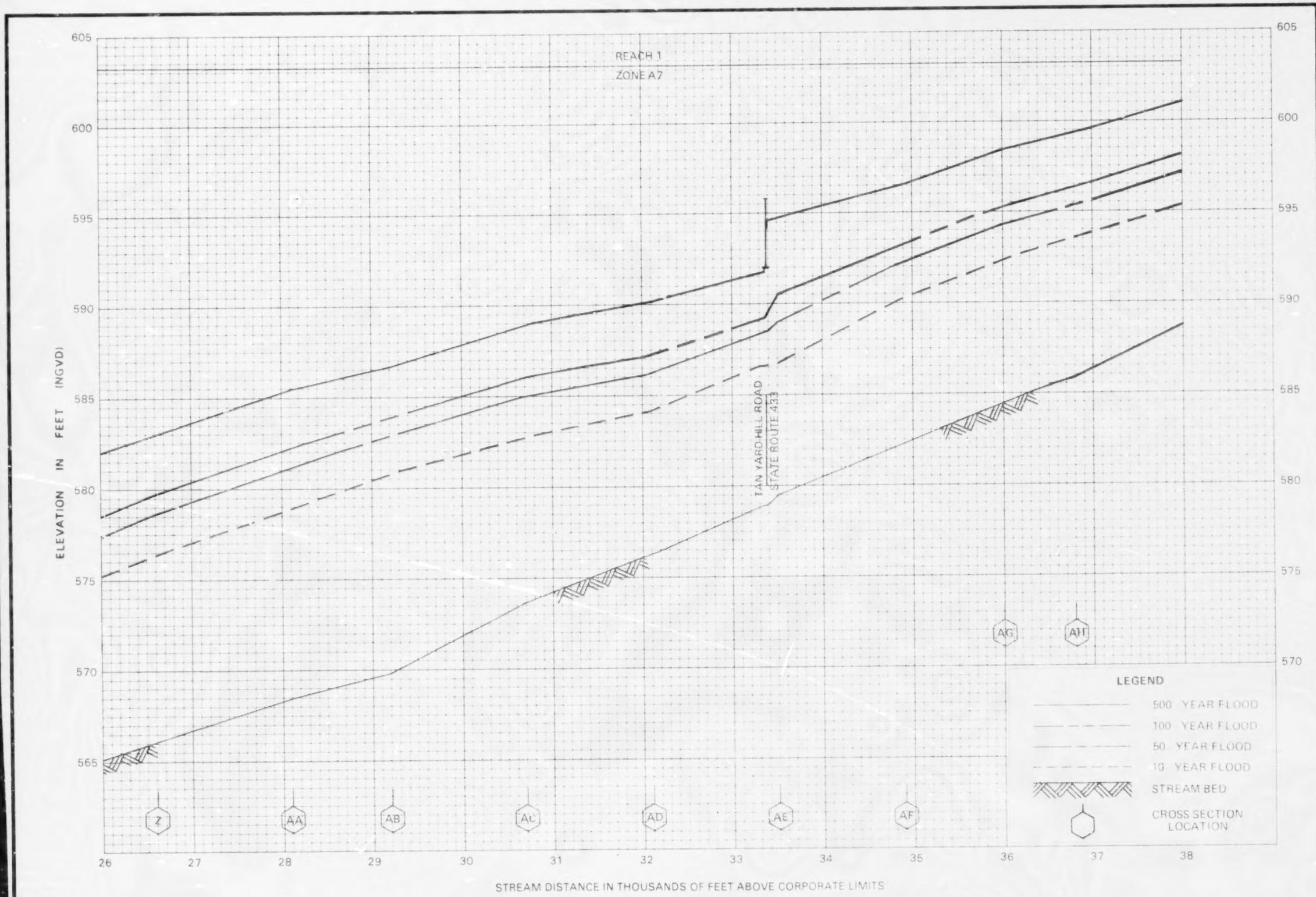

FLOOD PROFILES

CONODOGUINET CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

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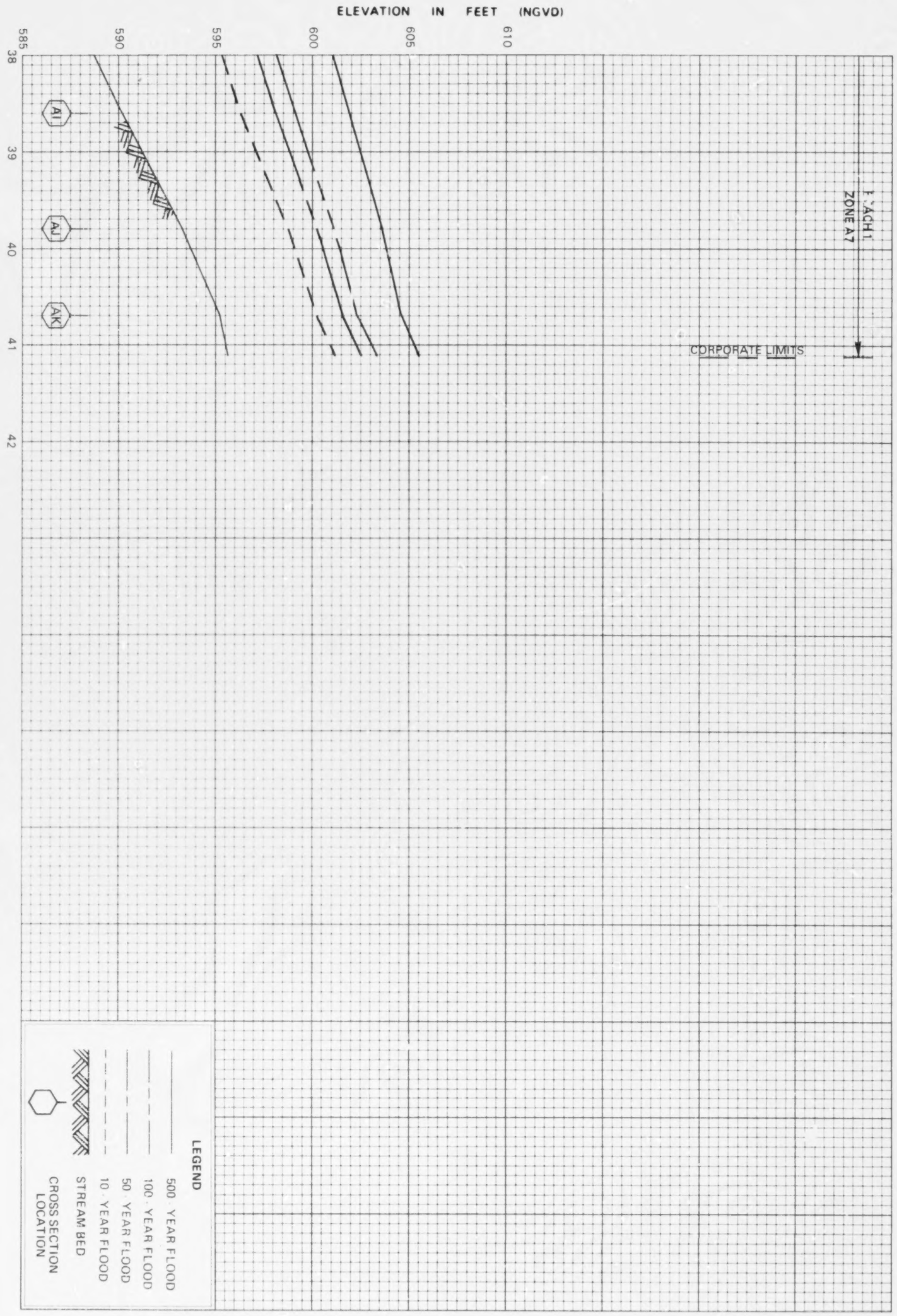

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOOD PROFILES

CONODOGUINET CREEK

04P

28

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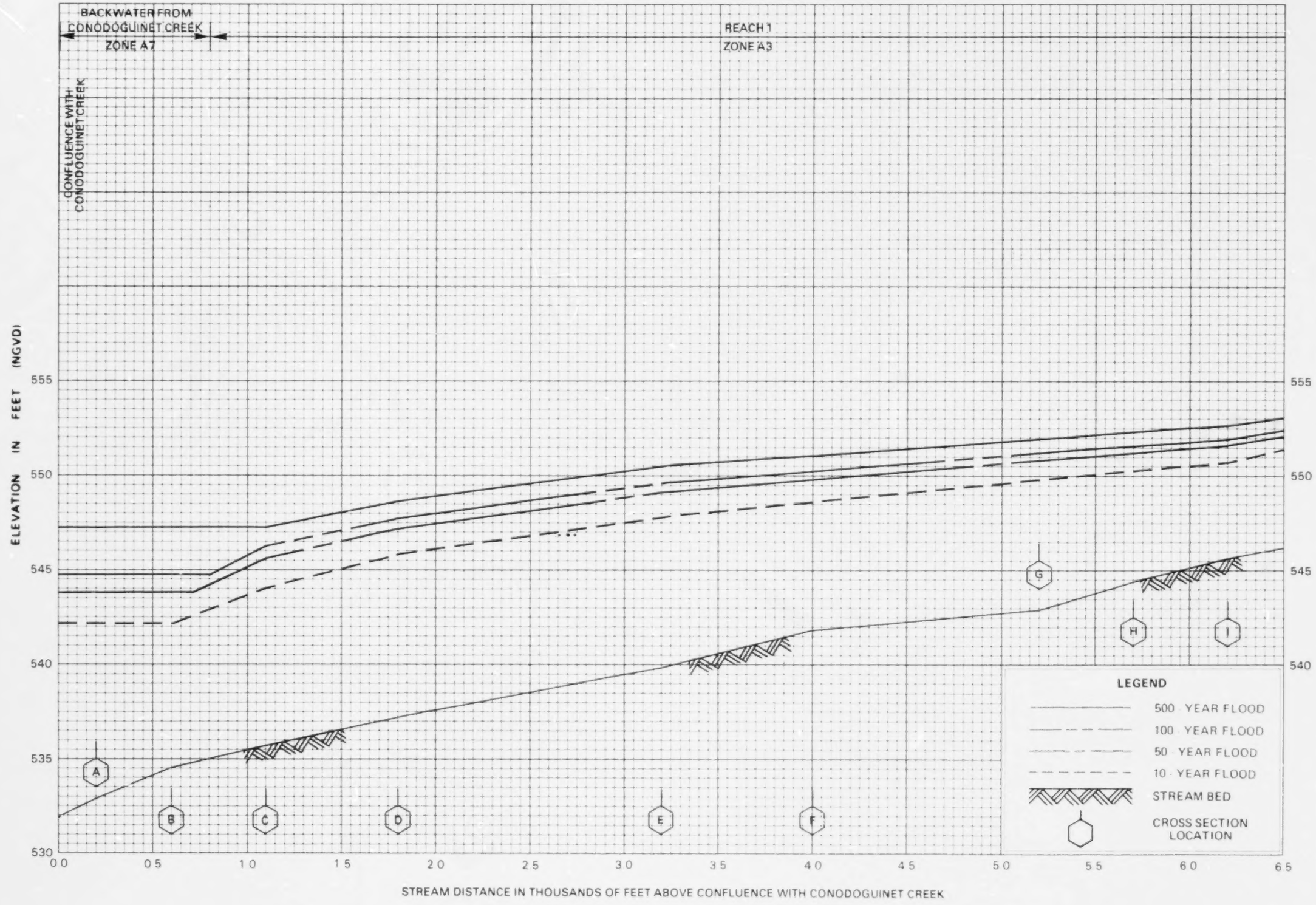

FLOOD PROFILES

MIDDLE SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

05P

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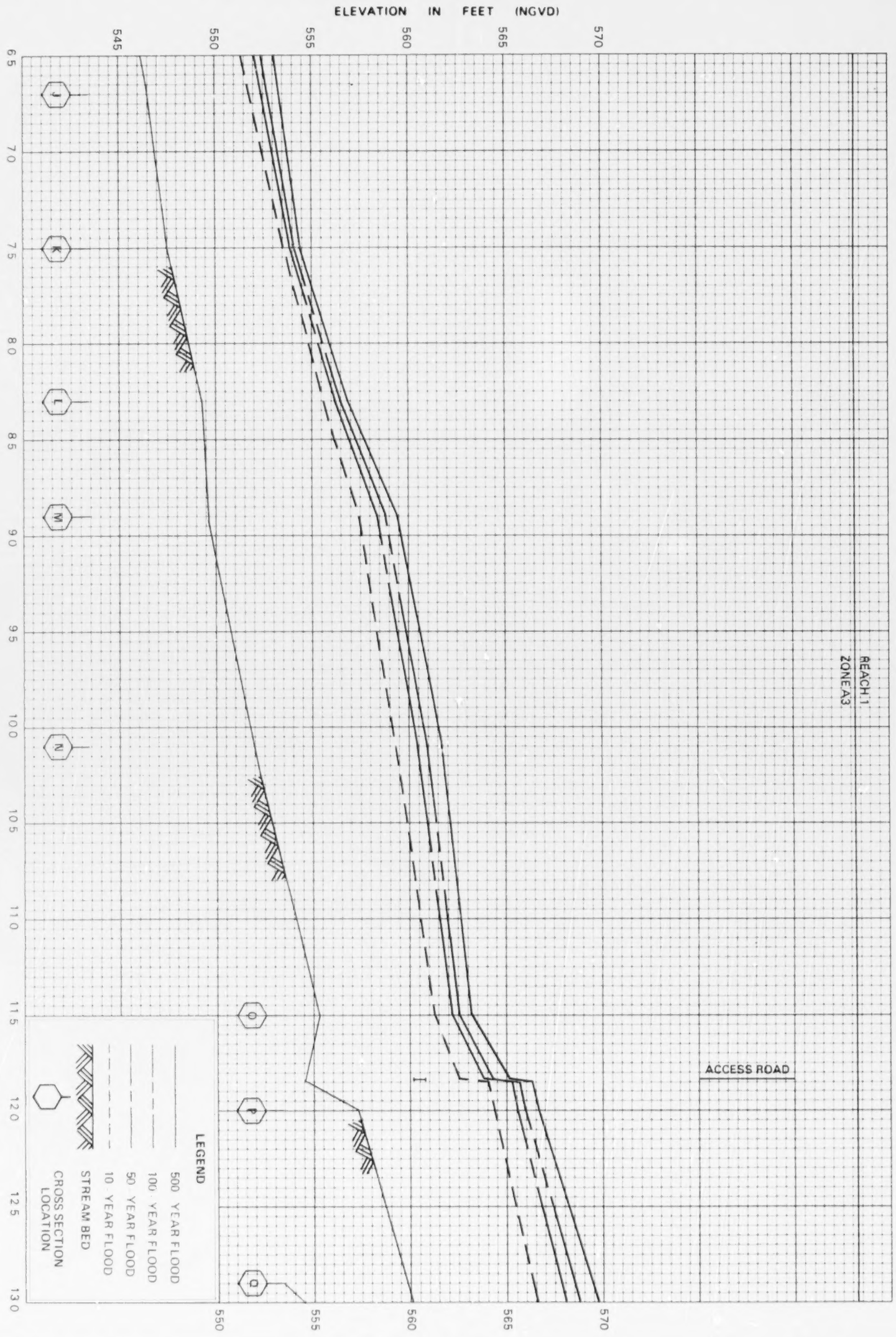

06P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWNSHIP OF SOUTHAMPTON, PA** (FRANKLIN CO.)	**FLOOD PROFILES** **MIDDLE SPRING CREEK**

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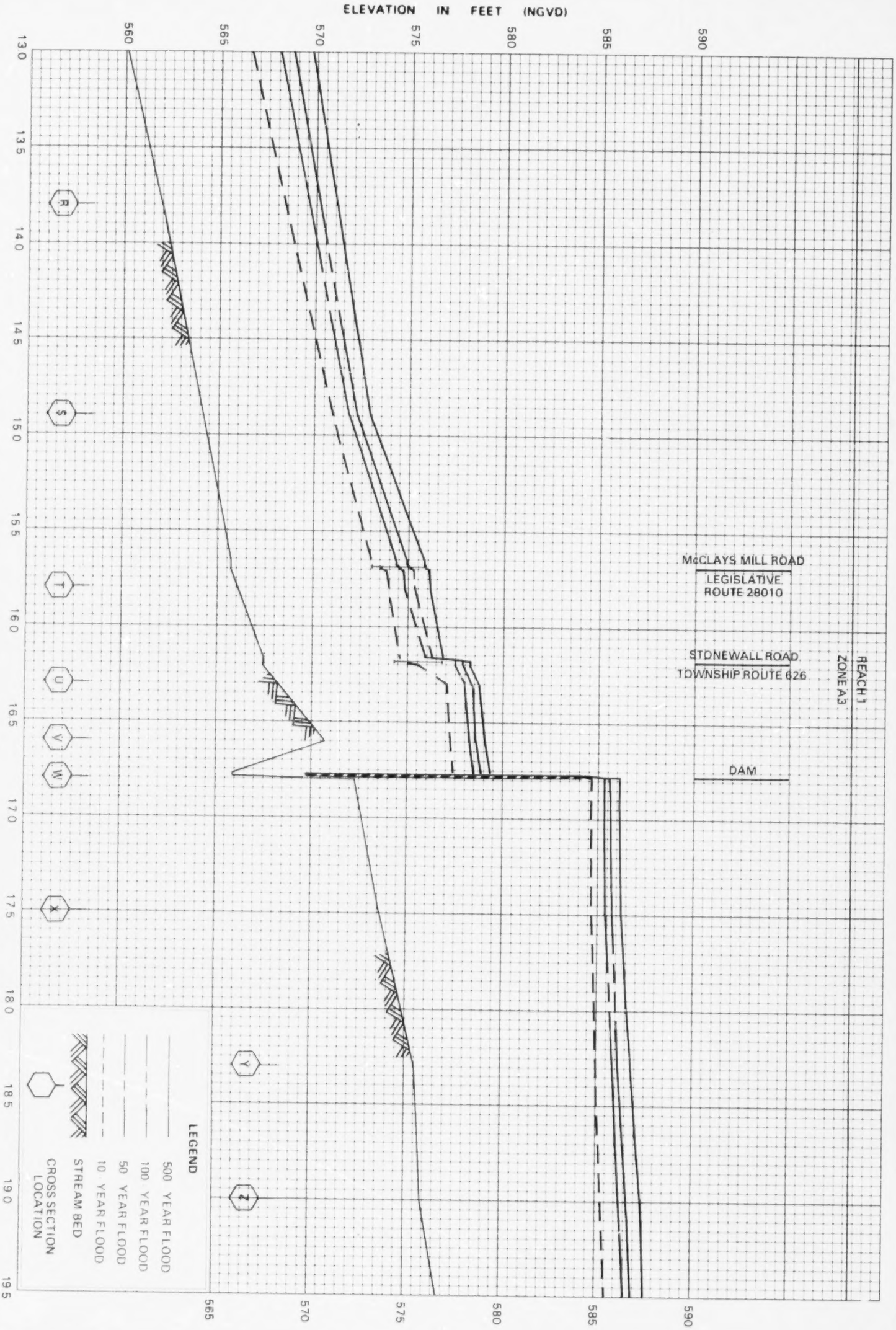

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOOD PROFILES

MIDDLE SPRING CREEK

07P

31

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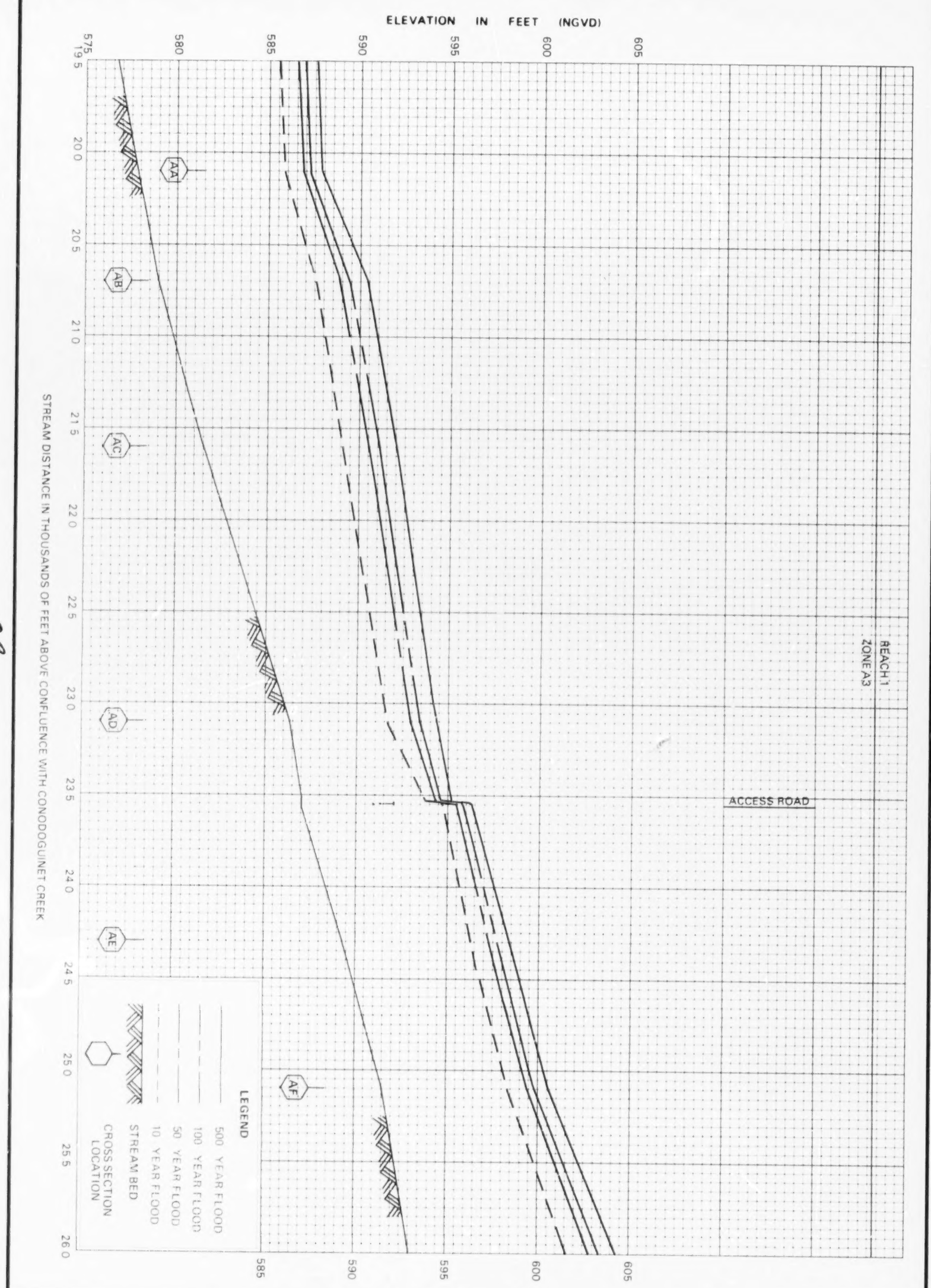


FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

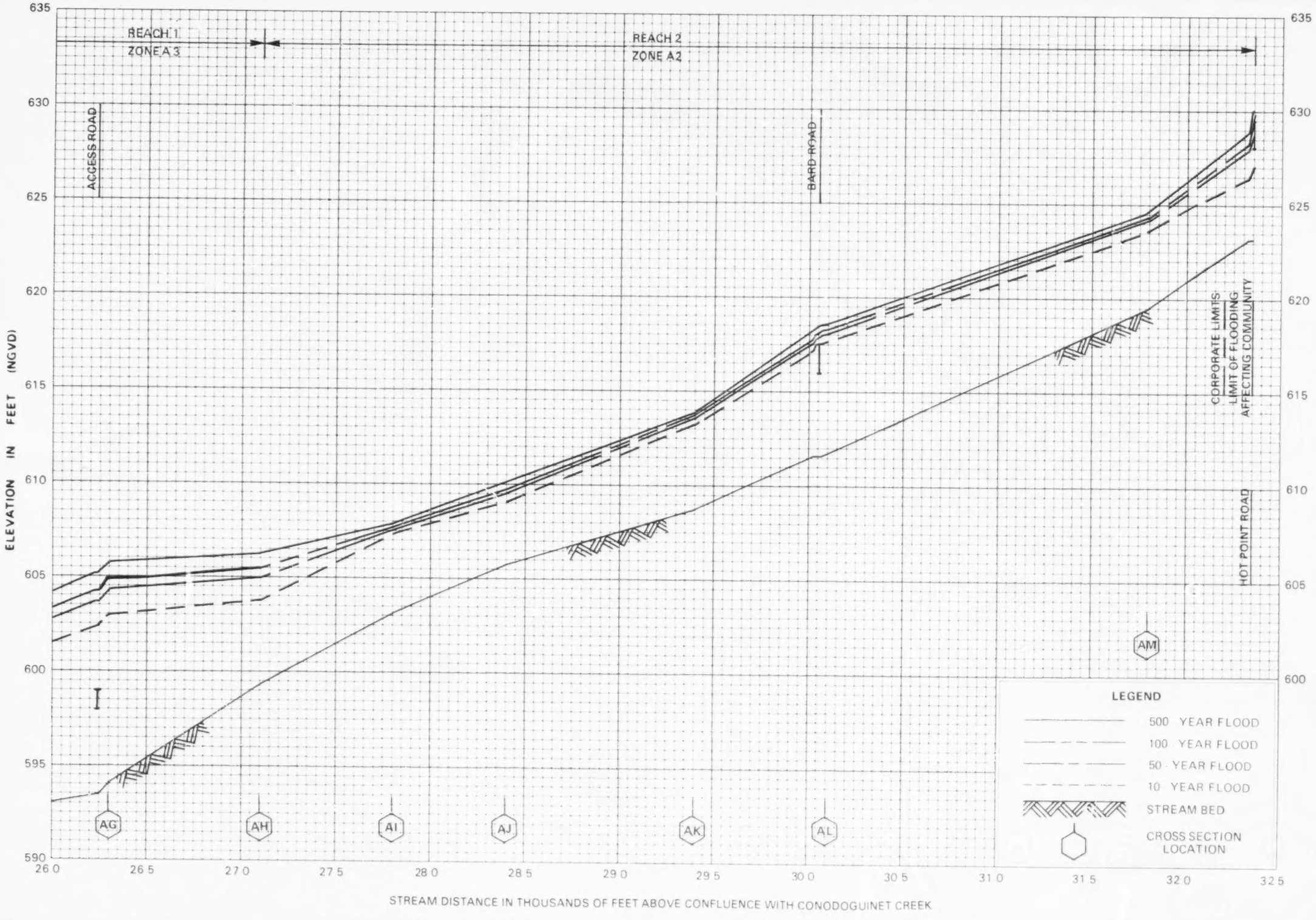
(FRANKLIN CO.)

FLOOD PROFILES

MIDDLE SPRING CREEK

08P

BEST COPY AVAILABLE



FLOOD PROFILES

MIDDLE SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

09P

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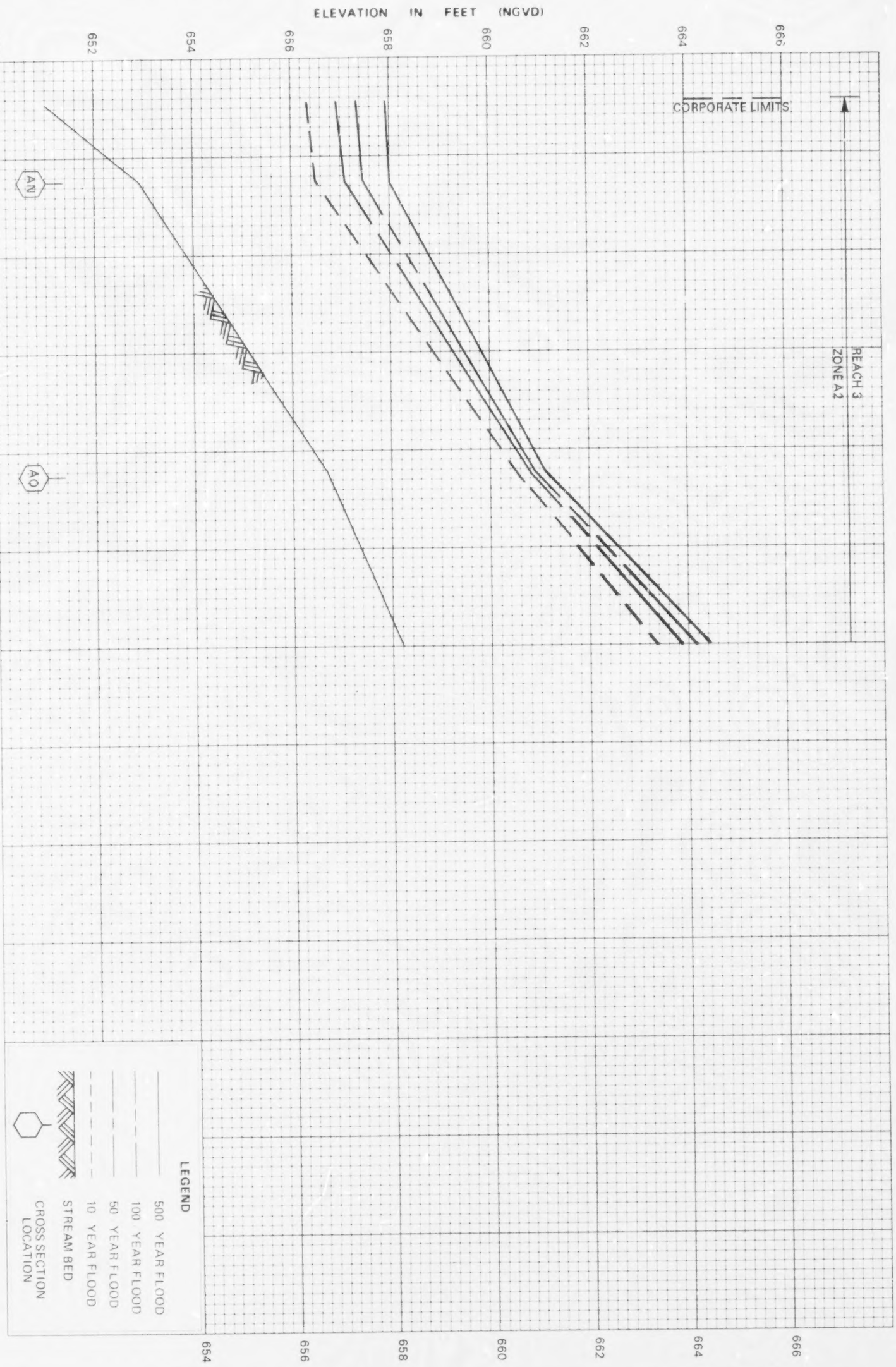


FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

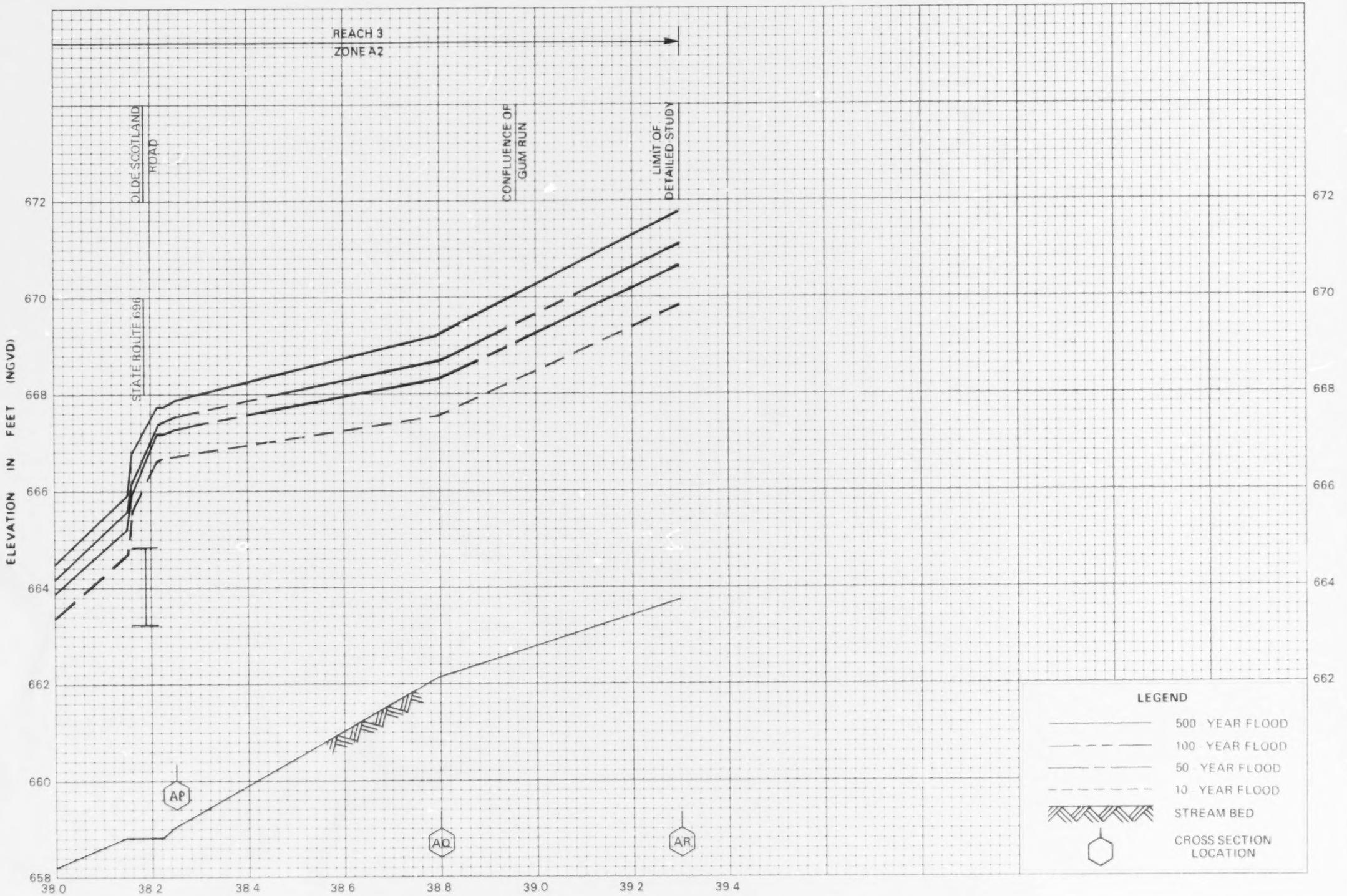
(FRANKLIN CO.)

FLOOD PROFILES

MIDDLE SPRING CREEK

10P

BEST COPY AVAILABLE



FLOOD PROFILES

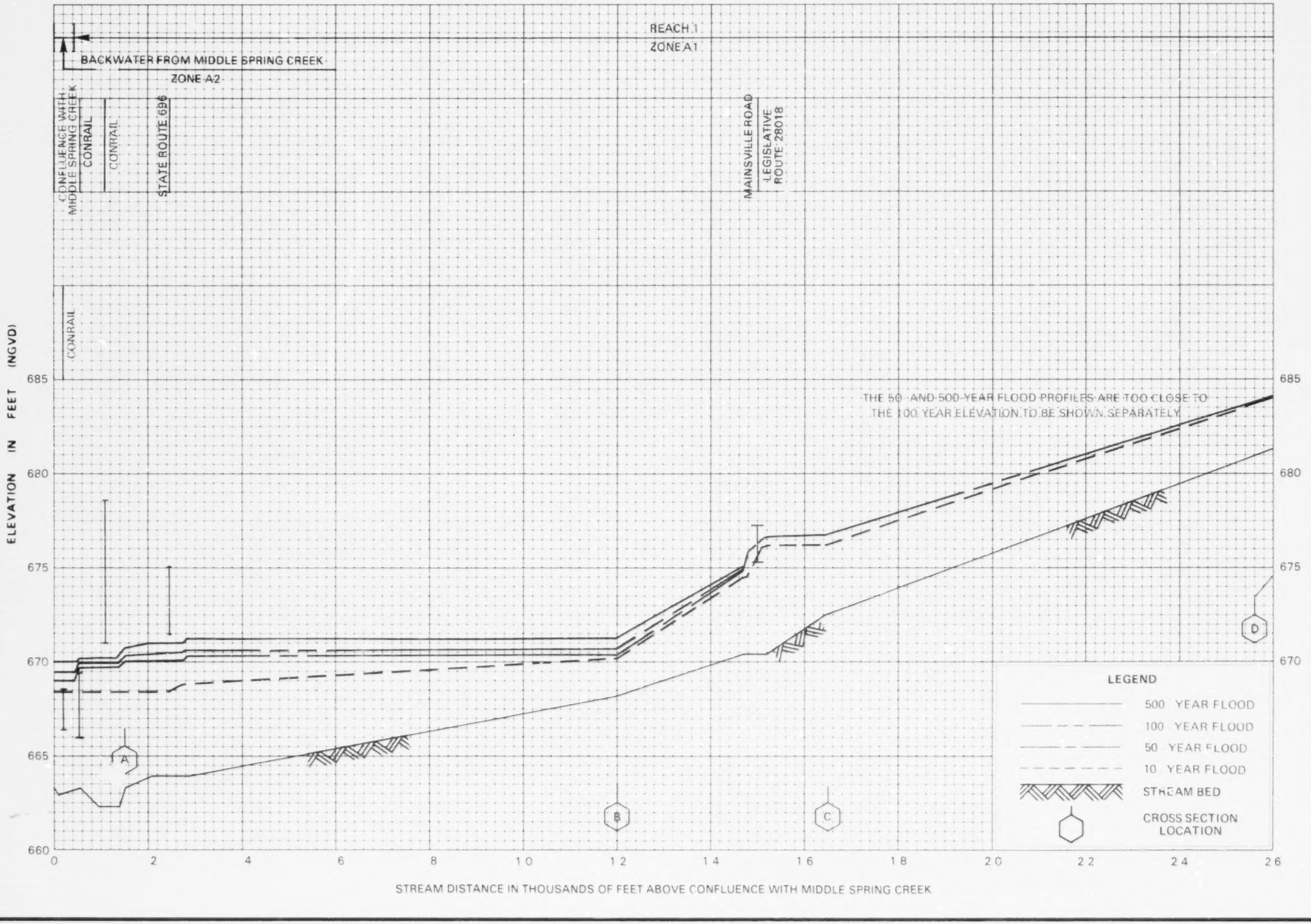
MIDDLE SPRING CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

11P

BEST COPY AVAILABLE



FLOOD PROFILES

GUM RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

12P

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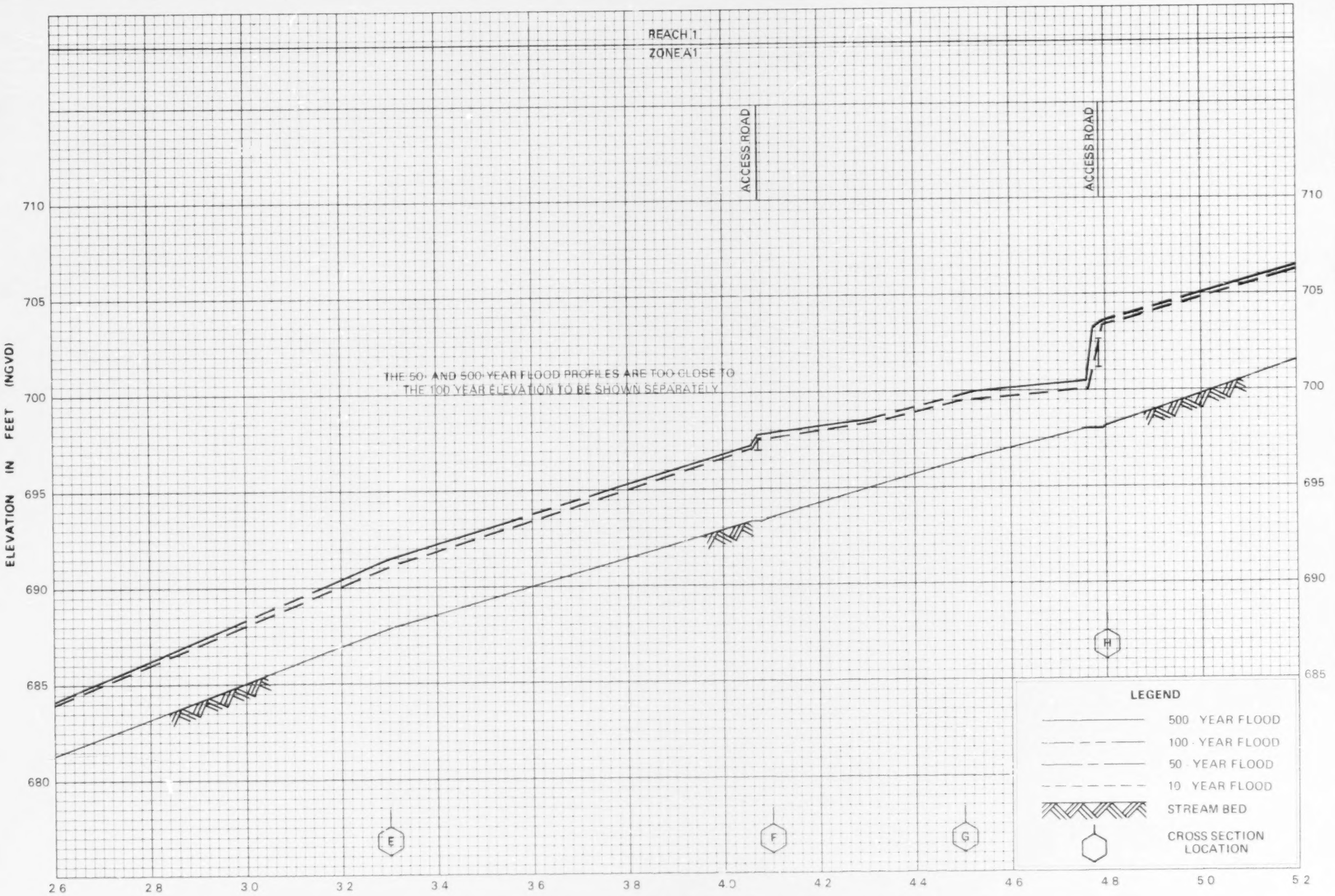

FLOOD PROFILES

GUM RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

13P

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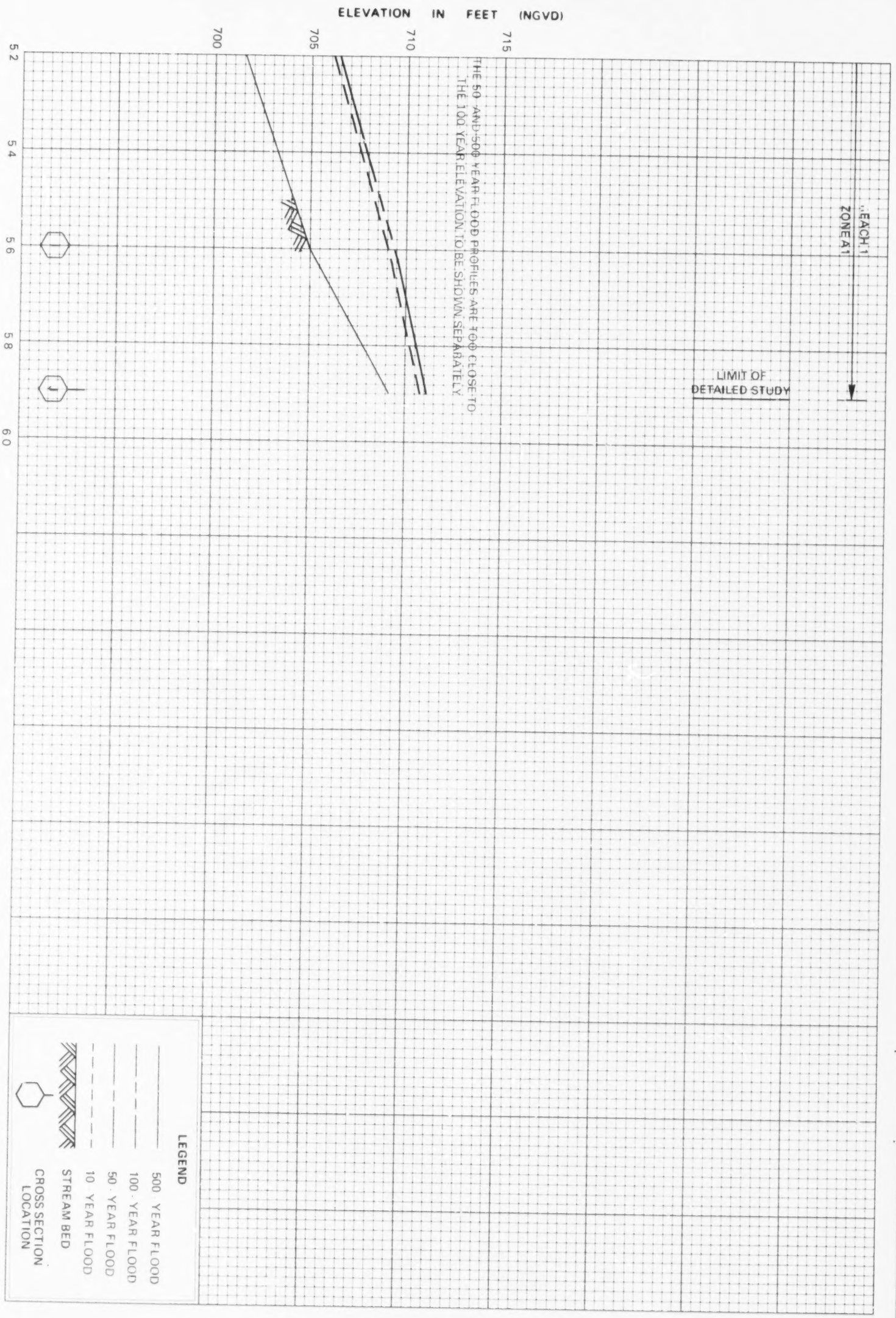


38

BEST COPY AVAILABLE

14P

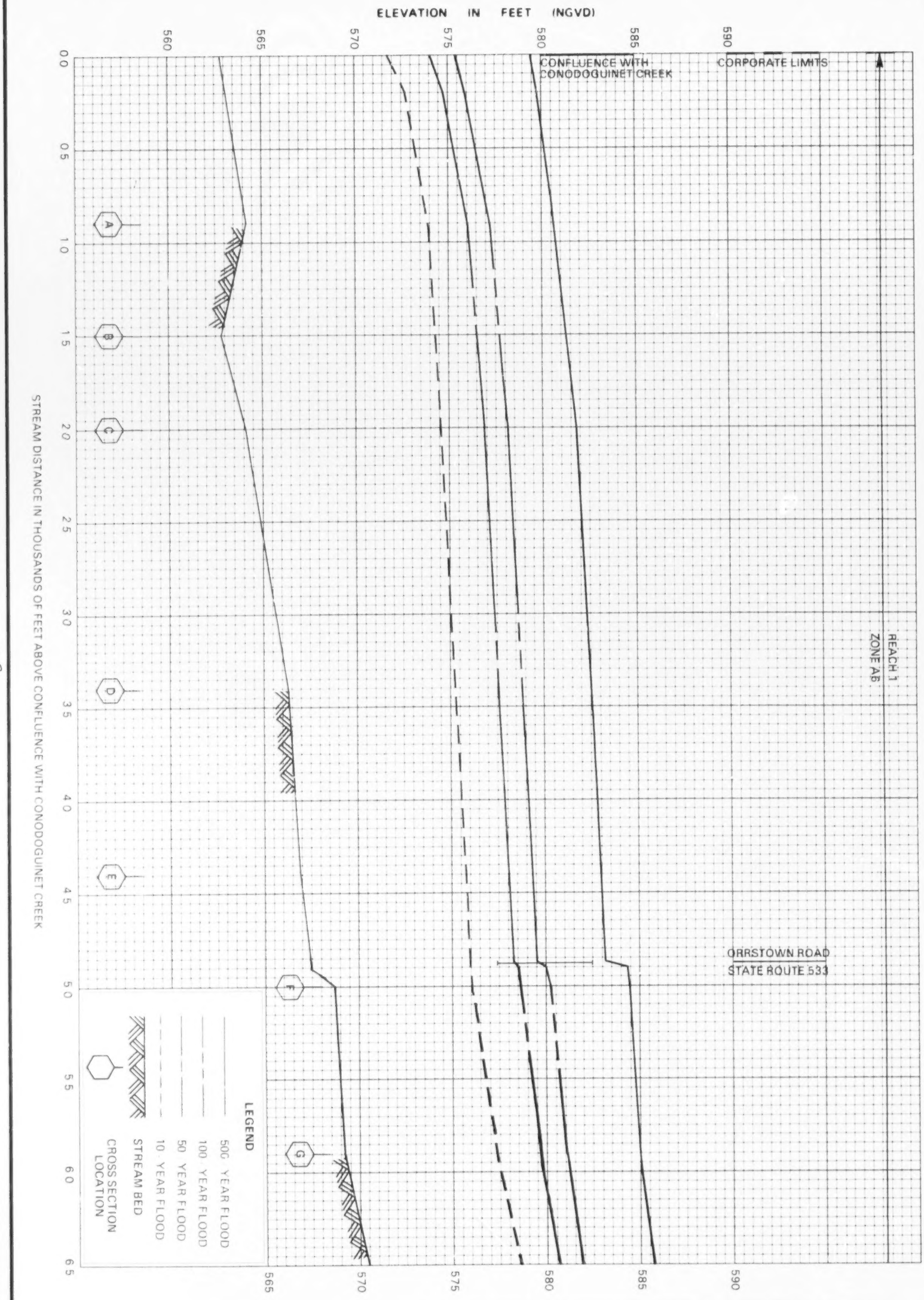
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

FLOOD PROFILES

GUM RUN



15P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

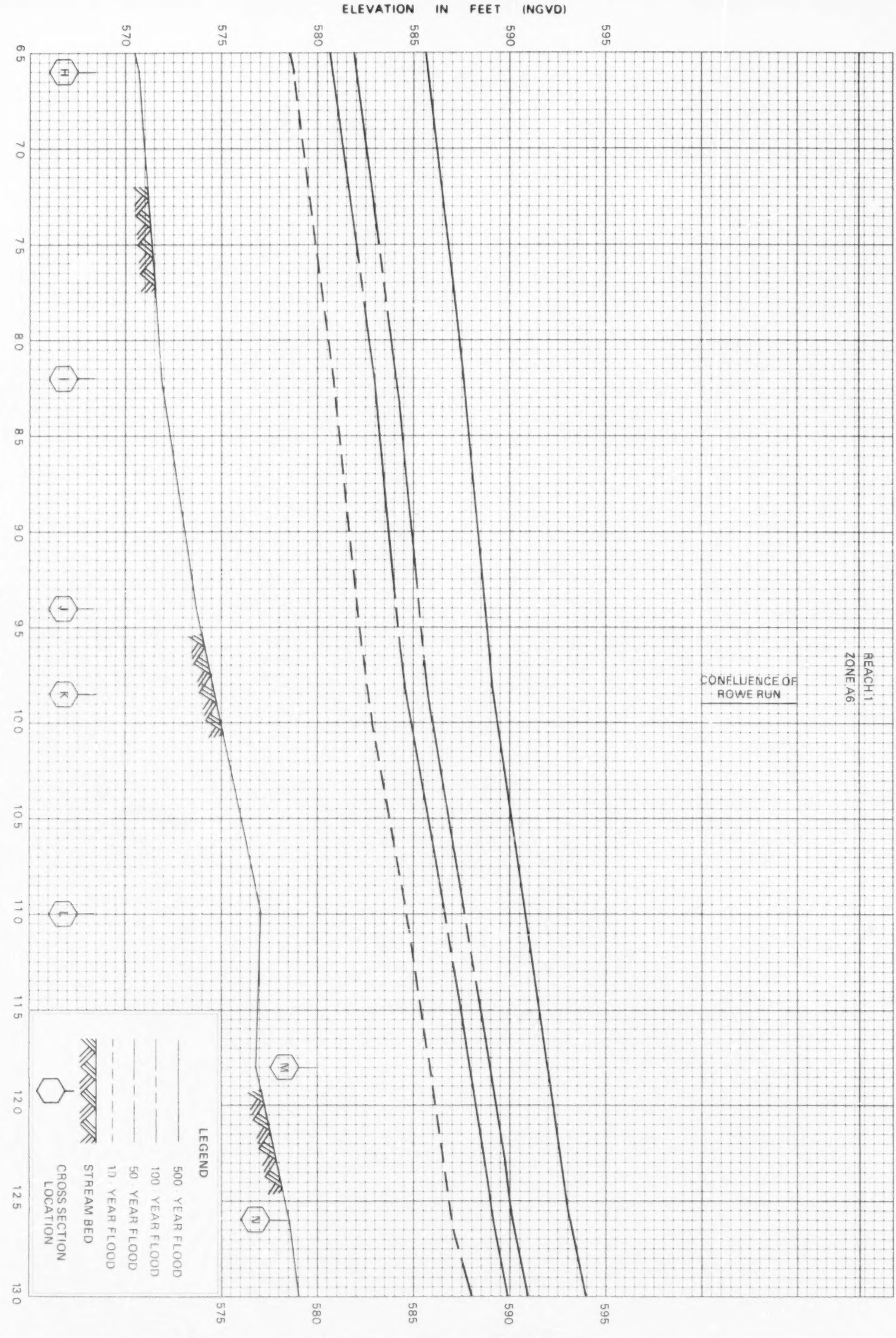
(FRANKLIN CO.)

FLOOD PROFILES

MUDDY RUN

39

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

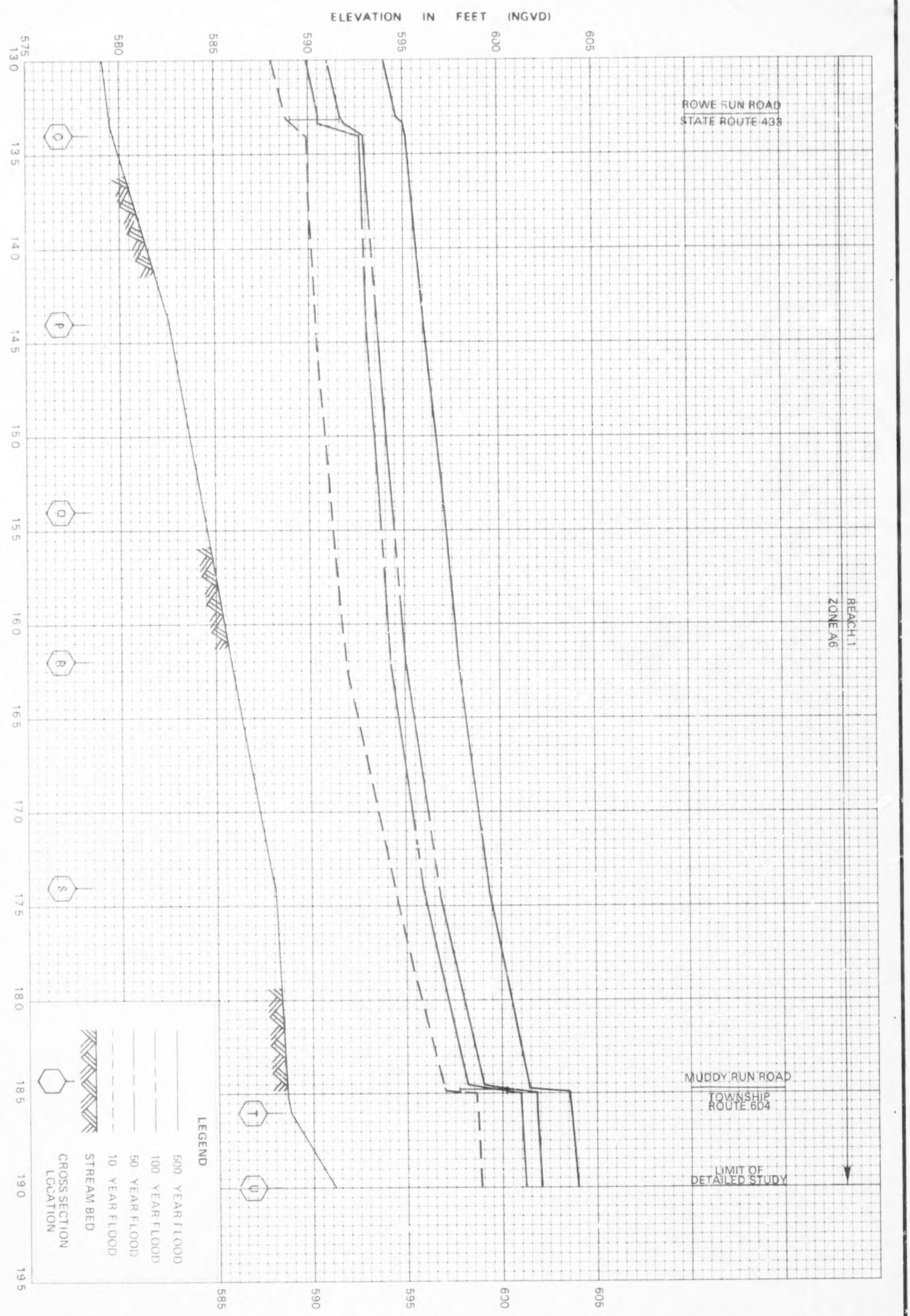
(FRANKLIN CO.)

FLOOD PROFILES

MUDDY RUN

16P

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

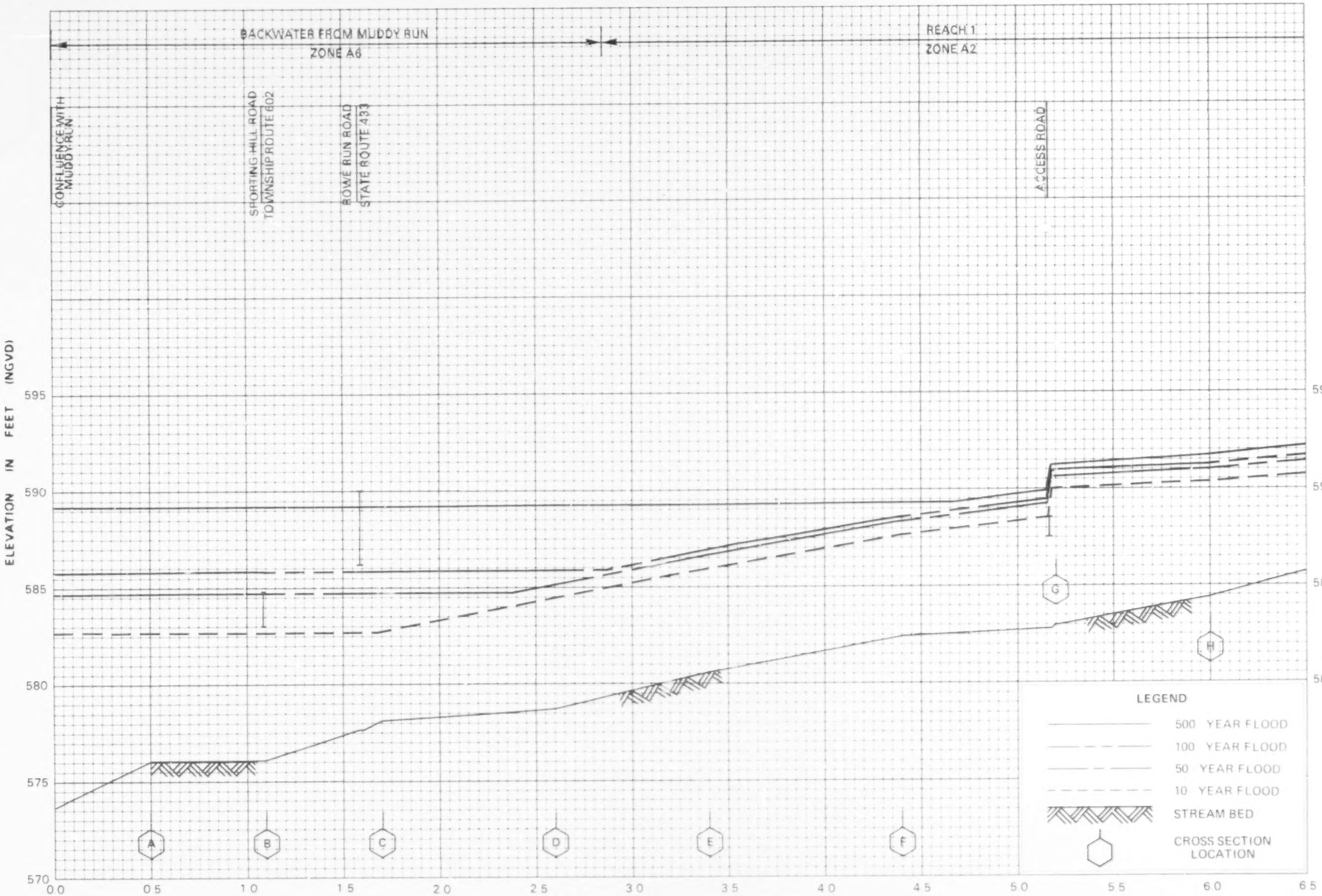
(FRANKLIN CO.)

FLOOD PROFILES

MUDDY RUN

17P

BEST COPY AVAILABLE



FLOOD PROFILES

ROWE RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

18P

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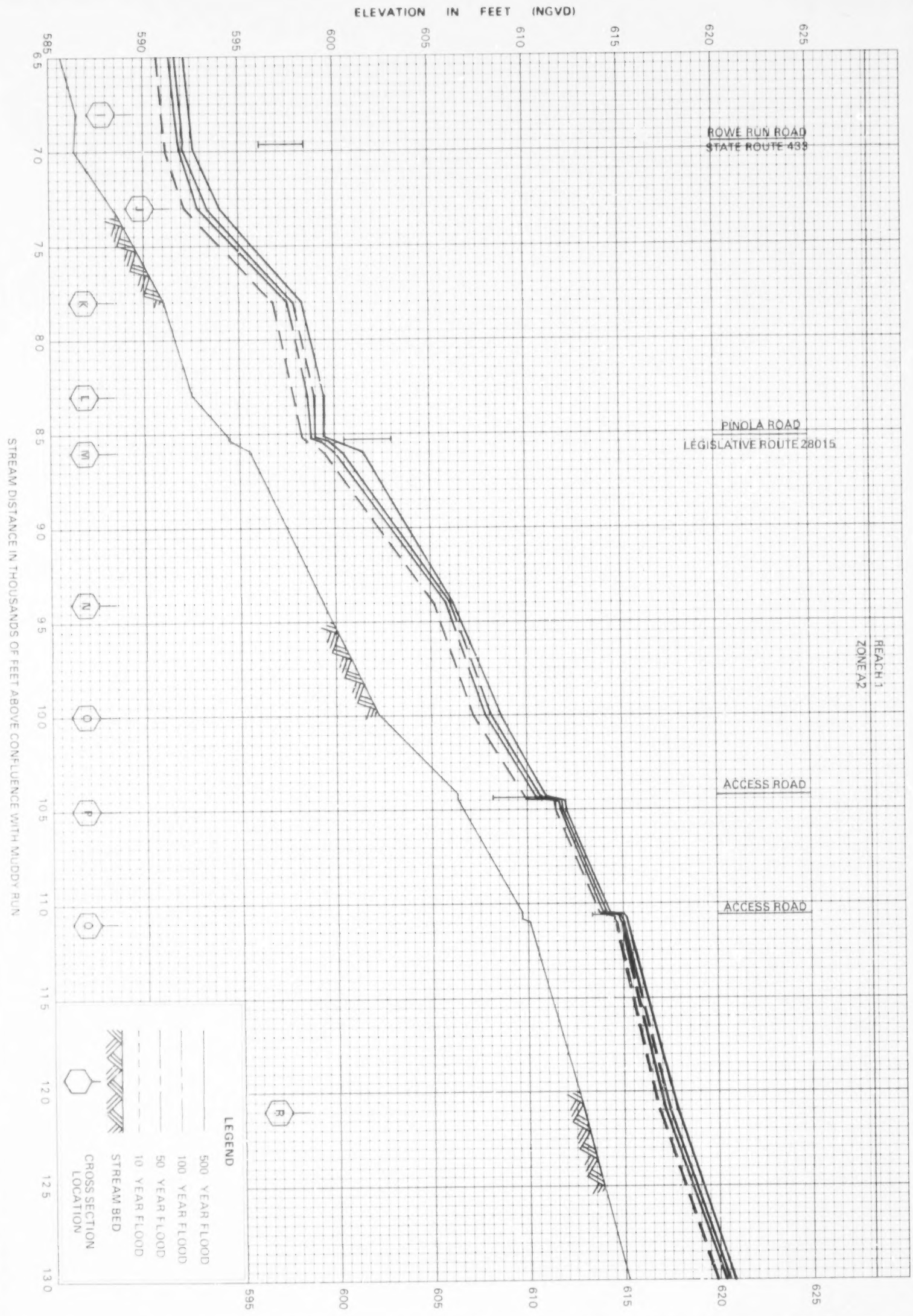

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA

(FRANKLIN CO.)

19P

FLOOD PROFILES

ROWE RUN

43

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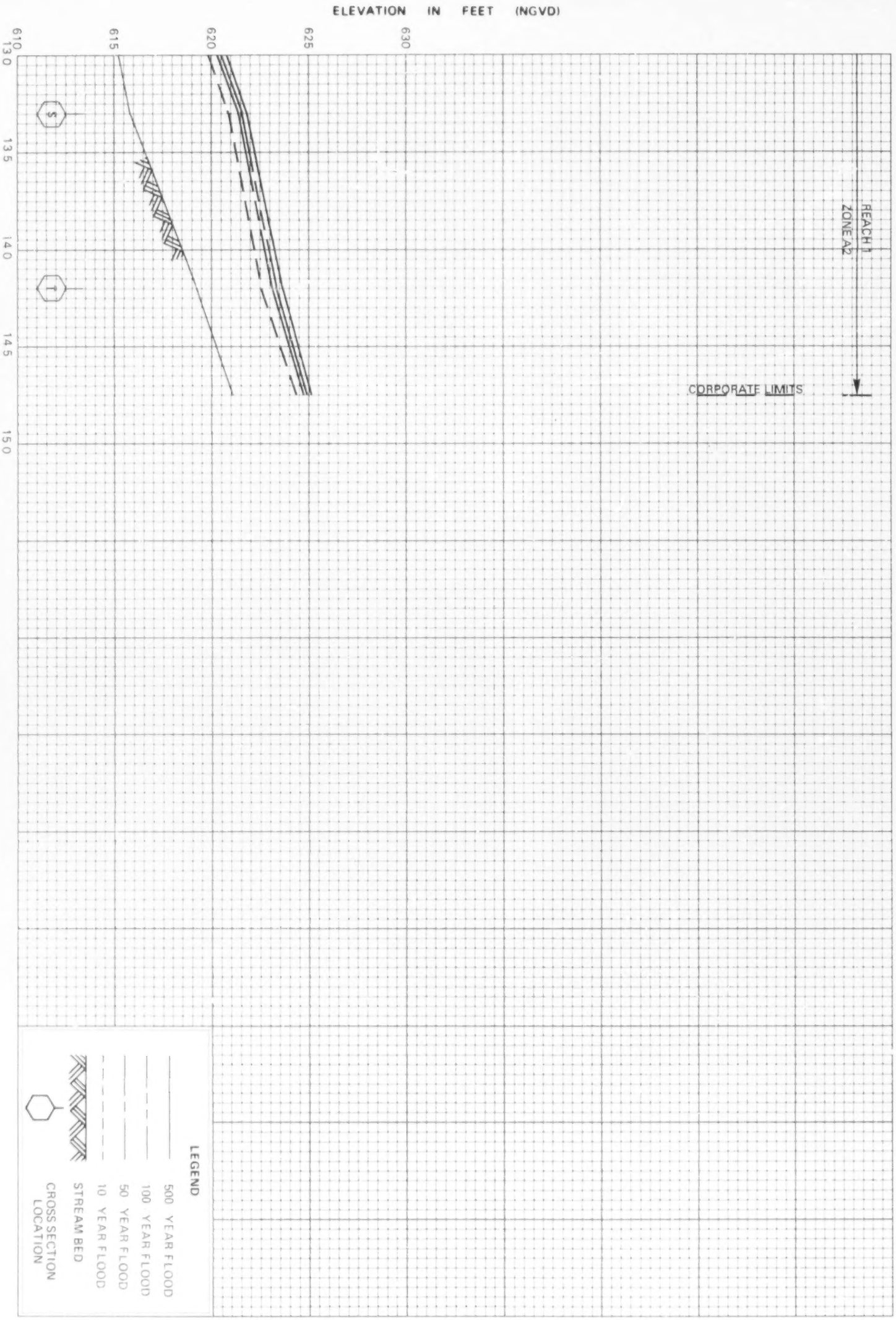

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH MUDDY RUN

BEST COPY AVAILABLE

20P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF SOUTHAMPTON, PA
(FRANKLIN CO.)

FLOOD PROFILES

ROWE RUN